

























ANNALS  
OF THE  
SOUTH AFRICAN MUSEUM

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*VOLUME XVI*





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SOUTH AFRICAN MUSEUM

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## LIST OF CONTRIBUTORS.

S. GARABEDIAN.	PAGE
Contributions to a Knowledge of the Flora of South-West Africa.	
No. 1. List of Grasses. Plate VIII . . . . .	381
E. P. PHILLIPS.	
A Contribution to the Flora of the Leribe Plateau and Environs: with a Discussion on the Relationships of the Floras of Basutoland, the Kalahari, and the South-eastern Regions. Plates I-VII . . . . .	1
M. A. POOCK.	
<i>Volvox</i> and Associated Algae from Kimberley. With Field Notes by J. H. POWER. Plates XXV-XXXVII, and Seven Text-figures . . . . .	473
M. A. POOCK.	
<i>Volvox</i> in South Africa. Plates XXXVIII-XLIX, and Ten Text-figures . . . . .	523
F. RICH and M. A. POOCK.	
Observations on the Genus <i>Volvox</i> in Africa. Plates IX-XXIV, and Six Text-figures . . . . .	427





DATE OF ISSUE OF THE PARTS.

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Part 3, July, 1933.







## LIST OF PLATES.

- PLATE
- I. *Lobelia Tysonii* Phillips. *Anthrixia fontana* MacOwan.
- II. *Blepharis espinosa* Phillips. *Utricularia humilis* Phillips.
- III. { *Lotononistrisegmentata* Phillips. *Wahlenbergia depressa* W. & E.  
  \ *Lobelia aquatica* Phillips.
- IV. *Euryops Annae* Phillips.
- V. { *Heliophila basutica* Phillips. *Psammotropha androsacea* Fenzl.  
  \ *Wahlenbergia basutica* Phillips. *W. depressa* W. & E.
- VI. { *Helichrysum calocephalum* Schltr. *H. radnii* Sp. Moore.  
  \ *Crepis polyodon* Phillips. *H. chionosphaerum* D.C.
- VII. Map of Basutoland.
- VIII. Map of South-West Africa.
- IX.-XXIV. South African *Volvox*.
- XXV.-XXIX. *Volvox gigas*.
- XXX. *Volvox gigas* and *africanus*.
- XXXI.-XXXIII. *Volvox africanus*.
- XXXIV. *Volvox rousseletii* forma *griquaensis*.
- XXXV. *Volvox rousseletii* forma *griquaensis* and *Kirchneriella africana*.
- XXXVI.-XXXVII. *Sphaerocystis poweri*.
- XXXVIII.-XLIX. *Volvox* in South Africa.





## INDEX OF GENERA.

Contained in Parts 2 and 3.

(An index of genera in Part 1 will be found on pp. 372-377.)

A	PAGE	F	PAGE
Agrostis . . . . .	400	Fingerhuthia . . . . .	425
Amphilophis . . . . .	384		
Andropogon . . . . .	386	H	
Antheephora . . . . .	395		
Aristida . . . . .	400	Hemarthria . . . . .	383
Arundo . . . . .	398	Heteropogon . . . . .	387
		Hyparrhenia . . . . .	387
B		I	
Brachiaria . . . . .	389		
Bromus . . . . .	426	Imperata . . . . .	383
C		K	
Chloris . . . . .	421		
Cymbopogon . . . . .	386	Kirchneriella . . . . .	506
Cynodon . . . . .	420	L	
D		Leptochloa . . . . .	419
Dactyloctenium . . . . .	422	Leucophrys . . . . .	389
Danthonia . . . . .	398	M	
Dichantium . . . . .	385		
Digitaria . . . . .	388	Microchloa . . . . .	419
Diplachne . . . . .	418	Monelytrum . . . . .	407
E		O	
Echinochloa . . . . .	391	Odyssea . . . . .	419
Ehrhata . . . . .	425	Oropetium . . . . .	419
Eleusine . . . . .	421	P	
Elyonurus . . . . .	383		
Elytrophorus . . . . .	426	Panicum . . . . .	392
Enneapogon . . . . .	423	Paspalum . . . . .	390
Enteropogon . . . . .	420	Pennisetum . . . . .	396
Entoplocamia . . . . .	426	Pentaschistis . . . . .	398
Eragrostis . . . . .	410	Perotis . . . . .	407
Eremopogon . . . . .	385	Phragmites . . . . .	399
Eriochloa . . . . .	388	Pogonarthria . . . . .	409
Eudorina . . . . .	479	Polypogon . . . . .	399
Eulalia . . . . .	383		
Eustachys . . . . .	421		

S				U			
			PAGE				PAGE
Schismus . . . .			426	Urochloa . . . .			390
Schizachyrium . . . .			385				
Schmidtia . . . .			424				
Setaria . . . .			393				
Sorghum . . . .			384				
Sphaerocystis . . . .			501				
Sporobolus . . . .			407				
Stipa . . . .			406				
T				V			
Themeda . . . .			388	Vetiveria . . . .			384
Trachypogon . . . .			387	Volvox . . . .		427, 480, 529,	647
Tragus . . . .			406	Vossia . . . .			383
Trichopteryx . . . .			398				
Tricholaena . . . .			394				
Tripogon . . . .			423				
Triraphis . . . .			422				
				W			
				Wilkommia . . . .			419
				X			
				Nyochlaena . . . .			395

# ANNALS OF THE SOUTH AFRICAN MUSEUM.

(VOL. XVI.)

1. - *A Contribution to the Flora of the Leribe Plateau and Environs : with a Discussion on the Relationships of the Floras of Basutoland, the Kalahari, and the South-Eastern Regions.*—By E. P. PHILLIPS, M.A., D.Sc., F.L.S., Assistant.

## CONTENTS.

	PAGE
I. INTRODUCTION . . . . .	2
II. THE LERIBE FLORA . . . . .	3
Orography and Geology . . . . .	3
Meteorology . . . . .	4
Oecological and Biological Features . . . . .	5
Native Names and uses of Plants . . . . .	10
Alien Flora . . . . .	12
Systematic Constituents of the Flora . . . . .	13
III. THE EASTERN MOUNTAIN REGION. . . . .	14
Orography . . . . .	15
Geology . . . . .	17
Meteorology . . . . .	19
Systematic Constituents of the Flora . . . . .	21
IV. THE KALAHARI FLORA . . . . .	23
Introduction . . . . .	23
Meteorology . . . . .	25
Systematic Constituents of the Flora . . . . .	26
V. A COMPARISON OF THE FLORAS OF THE EASTERN MOUNTAIN AND KALAHARI REGIONS . . . . .	27
VI. THE SOUTH-EASTERN REGION . . . . .	30



VII. A COMPARISON OF THE FLORA OF THE EASTERN MOUNTAIN AND SOUTH-EASTERN REGIONS . . . . .	31
VIII. SUMMARY . . . . .	32
IX. LIST OF SPECIES OCCURRING IN THE EASTERN MOUNTAIN REGION, WITH DESCRIPTIONS OF NEW SPECIES . . . . .	33
X. INDEX TO GENERA . . . . .	372

## I. INTRODUCTION.

THE present paper is the outcome of an investigation undertaken by the writer, of the flora of Leribe in northern Basutoland. Hitherto Basutoland has not received the attention from botanical collectors which it deserves, and the only collections as far as I am aware, are those of Cooper, who journeyed through Basutoland (unfortunately his plants are not properly localised); the Rev. J. Buchanan, who botanised in the Leribe District; Mr. J. Thode, who collected on the Basutoland side of the Drakensbergen; and Mr. E. E. Galpin, who explored the high mountains separating Basutoland from Barkly East and as far inland as the Buffalo River Waterfall. The results of Mr. Galpin's investigations were read before the South African Association for the Advancement of Science in 1908.

The Rev. H. Dieterlen and his wife, Madame A. Dieterlen, of the French Protestant Missionary Society, who were stationed for many years at Leribe, have been deeply interested in the local flora. Madame Dieterlen has made an exhaustive collection of the native plants, the bulk of which she forwarded to the South African Museum herbarium for identification. The writer has thus had unique opportunities during the past seven years of becoming fairly well acquainted with a part of the Basutoland flora, and more especially with that of Leribe. In February 1913, he paid a visit to Leribe for the purpose of studying the flora on the spot.

When naming Madame Dieterlen's plants and comparing them with the specimens in our herbarium, I was particularly struck by the fact that so many of the species also occurred in the Eastern parts of South Africa such as the Transkei, Komgha, Pondoland, East Griqualand, Natal, etc., and then came to the conclusion that Basutoland ought not to be included in the Kalahari Region. This led me to make a more detailed study of the subject, with the result that I have attempted in the following pages to prove what Bolus\* first suggested, viz. that Basutoland and parts of the surrounding country form a distinct floral area.

\* "Sketch of the Floral Regions of South Africa," *Science in South Africa*. Cape Town. 1905.

The principal collections (besides those of Madame Dieterlen and my own) which have been examined and embodied in the list at the end of the paper are the following: Dr. Bolus' and Mr. H. G. Flanagan's, made in the neighbourhood of Witzie's Hoek and the Montaux-Sources; collections made by Messrs. J. Thode, J. M. Wood, and M. Evans on the Drakensbergen and the higher parts of Natal; Mr. Galpin's and Drège's collections from the high mountains separating Basutoland from Barkly East; Burke and Zeyher's, from the Orange Free State.

My thanks are due to Mrs. F. Bolus, B.A., the Curator of the Bolus Herbarium, South African College, Cape Town, who has allowed me every facility for consulting that collection, and who has verified the naming of some species of *Orchidaceae* and *Mesembrianthemum*; to Dr. S. Schönland, M.A., of the Albany Museum, Grahamstown, who examined some critical species of *Crassulaceae*; to Dr. O. Stapf, F.R.S., the Curator of the Kew Herbarium, who named some of the *Gramineae* and *Cyperaceae*; to the late Dr. J. M. Wood and Mr. E. E. Galpin, F.L.S., who kindly sent me for examination some type specimens which were in their respective collections. To Madame Dieterlen I am under a deep debt of gratitude for her hospitality, which was extended to me and my wife when at Leribe; for her efforts in obtaining the Sesuto names and uses of the local flora; and for allowing me the use of her large herbarium. It is due solely to her untiring zeal and energy that our knowledge of the Leribe flora has been gained.

## II. THE LERIBE FLORA.

### OROGRAPHY AND GEOLOGY.

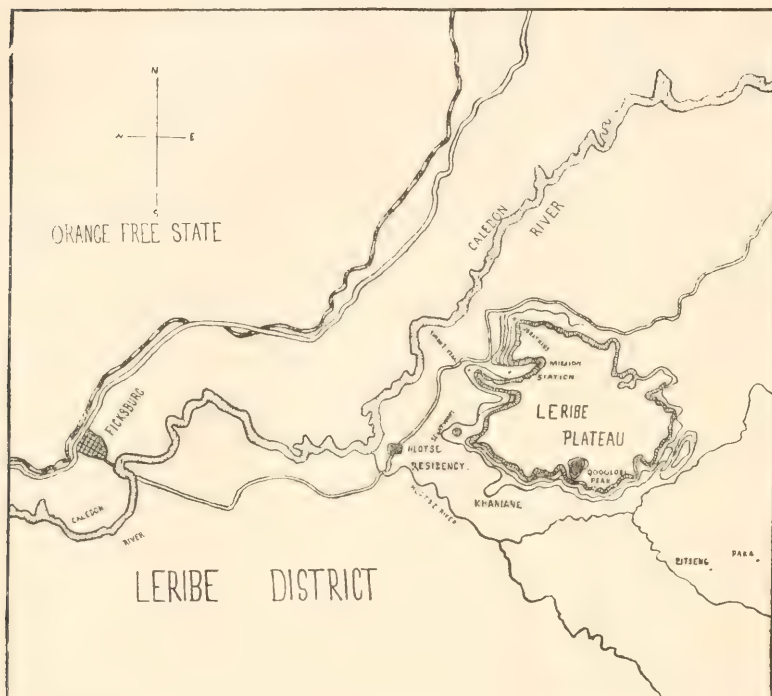
The portion of the country investigated botanically was the Leribe Plateau, its slopes, ravines, and the surrounding plains (see fig. 1).

Leribe Plateau is situated in the Leribe District, Northern Basutoland, not far from the borders of the Orange Free State. The plateau stands as an isolated table-land, 5-6000 ft. high, sharply marked off from the surrounding plain by walls of rock which rise perpendicularly for 2-300 ft. The area of the summit is roughly 30 sq. miles. At the southern end is a peak, Qoqolosi Peak, which reaches nearly 8000 ft. in altitude. The lower slopes of the plateau merge gradually into the plain, and numerous ravines, with rocky stream-beds, are found all round its boundaries.

The plateau is built up of Cave-sandstone belonging to the Stormberg Series (see also geology of the Eastern Mountain Region) with a

capping of dolerite on Qoqolosi Peak. The plain and valley of the Caledon River are composed of silt washed down by the streams and mountain torrents which are suddenly formed during the heavy summer rains.

FIG. 1.



#### METEOROLOGY.

I have been unable to obtain records of the temperature at Leribe, but from data available we know that extremes of heat and cold are experienced during the course of the year. During the months of June and July the temperature falls below freezing point during the night. Occasionally frost occurs as early as May and lasts until September, and snow falls once or twice a year but melts after a few hours, except on the highest peaks, where it sometimes remains for days or weeks. In summer, from November to March, severe hail-storms accompanied by thunder and lightning are frequent, and, as will be seen from the accompanying table, these are also the rainy months. The rains are usually preceded by northerly winds, but strong westerly winds blow from August to October. The country is

often subjected to drought, when the vegetation presents a scorched-up appearance.

The mean average rainfall at Leribe during the five years 1909–1913 was 27·01 in., most of which falls from December to March. The dry months are from June to September.

*Rainfall at Leribe Mission Station.\**

	1909.	1910.	1911.	1912.	1913.	Average for 5 years.
January .	10·12	6·84	2·25	1·49	2·73	4·68
February .	8·11	5·96	1·10	10·44	4·42	6·00
March .	3·32	3·14	6·25	1·59	3·75	3·61
April .	1·02	0·87	2·75	4·27	1·68	2·11
May .	2·39	0·64	1·97	2·02	0·19	1·44
June .	0·00	0·26	0·21	0·79	0·09	0·27
July .	0·11	0·15	0·85	0·24	0·02	0·27
August .	0·67	0·06	0·76	0·00	0·65	0·42
September .	1·23	1·77	0·05	0·01	0·65	0·74
October .	0·38	5·38	2·29	1·34	3·16	2·51
November	2·60	1·47	2·24	1·16	2·61	2·01
December	6·06	1·59	0·65	6·28	0·00	2·91

OECOLOGICAL AND BIOLOGICAL FEATURES.

The general aspect of the plains, slopes, and plateau is that of a grass-land, though in a few localities thickets composed principally of *Cussonia paniculata* and *Euclea lanceolata*, intertwined with *Rhoicissus cuneifolia*, are seen under the precipitous cliffs. The valley and plain are largely cultivated with maize and Kaffir-corn, while the plateau affords good grazing for numerous head of cattle, sheep, and goats. On the plain the predominant grass is *Eragrostis plana*, among which many herbaceous and sub-herbaceous plants are found. Owing to the extensive cultivation it is not surprising to find also a large number of imported weeds, and such species as *Datura Stramonium*, *Verbena officinalis*, *Chenopodium murale*, *C. ambrosioides*, *Alternanthera Achyrantha*, *Amaranthus paniculatus*, etc., are commonly met with.

On the west slopes of the plateau the predominant grasses are *Andropogon hirtus*, *Eragrostis curvula* var. *conferta*, *Anthistiria imberbis* var. *mollicoma*, and *Eragrostis plana*: *Tricholaena setifera*, *Elionurus argenteus*, *Setaria flabellata*, *Andropogon contortus*, *Pennisetum Thunbergii* are common, while less frequent are *Eragrostis*

\* Records kept by the Rev. H. Dieterlen.



*brizoides* and *E. gummiiflua*. Growing among the grasses are numerous annuals and perennials, mostly of a herbaceous character and low growth, few, except round marshy patches, exceeding 2 ft. in height. Some of the typical plants found in these localities were *Gnaphalium undulatum*, *Cynoglossum micranthum*, *C. enerve*, *Acrotome inflata*, *Cyanotis nodiflora*, *Conyza podocephala*, *Helichrysum rugulosum*, *Nemesia foetens* var., *Rhus Sonderi* var., *Mahernia coccocarpa*, *Zinnia multiflora*, *Salvia repens*, *Solanum indicum*, *Sutera filicaulis*, *Hieracium capense*, *Rhus discolor*, *Polygala rarifolia*, *Dianthus scaber*, *Striga elegans*, *Berkheya setifera*, *Vernonia Kraussii*. Under, or in the shade of, rocks or large boulders scattered on the slopes are found *Oldenlandia Heynei*, *Tephrosia capensis*, *Stachys aethiopica* var., *Eucomis undulata*, *Richardia albomaculata*, *Lobelia Erinus*, *Dicoma anomala*, and numerous ferns, all shade-loving plants. In damp patches *Cyperus usitatus* is found growing subsocially. The few bushes present are not sufficiently numerous in individuals to affect the landscape. Those which were recorded are *Asclepias fruticosa*, *Leonotis mollis*, *Rhus erosa*, and *Solanum indicum*.

The southern slopes of the plateau do not bear such a luxuriant grass formation as the western and northern slopes. The predominant grass present is *Eragrostis plana*. *Eragrostis curvula* var. *conferta*, so common on the western slopes, is here of secondary importance. It was on this side of the plateau that the heaths, orchids, and most of the bulbous plants were collected. The rest of the vegetation is of a very similar character to that described above, but only more evident owing to the less dense covering of grass. Many of the species taken here are common to the other slopes of the plateau, though some, such as *Pentanisia variabilis*, *Crassula parvula*, *Monsonia biflora*, *Pharnaceum detonsum*, *Wahlenbergia depressa*, *Phytolacca heptandra*, etc., were confined to this locality. In some places *Salvia stenophylla* and *Phytolacca heptandra* form large patches to the almost complete exclusion of other plants.

The western and northern ravines, as stated above, are thickly wooded. When the sides of the ravine are steep the bush extends to under the cliffs, but when the sides slope gently to the bed of the ravine they are covered with grass. *Leucosidea sericea* is the predominant tree. Of secondary importance are *Kiggeliera africana*, *Cassinopsis capensis*, *Ilex capensis*, *Rhamnus prinoides*, while specimens of *Plectronia ciliata* and *Celastrus luxifolius* are rare. The undergrowth is composed mainly of *Myrsine africana*, but *Euclea coriacea*, *Chytia pulchella* and *Buddleia salviaefolia* are common; *Rhus pyroides* being less frequent. At Lefi's Kloof, the grassy slopes on either side

of the broad shallow opening to the ravine proper are the habitats of the only *Protea* found at Leribe, viz. *P. caffra*. In habit it closely resembles *P. grandiflora* of the Western Province, and at a distance might easily be mistaken for that species. The area which the plants occupy is very limited, as no specimens are found in the deeper parts of the ravine. Numerous shade-loving plants, almost all herbaceous, are found growing in the ravines. Some are found on the damp grassy slopes in the shadow of the cliffs or under trees, others grow deeper down in the ravine under rocks. Among many such plants gathered were *Alepidea amatymbica*, *Hypoxis Gerrardi*, *Mysotis afropalustris*, *Geranium canescens*, *Galium rotundifolium*, *Scabiosa Columbaria*, and numerous ferns. The streams from the ravines, as they enter the level plain, form small marshes. Such situations are chiefly occupied by *Mariscus congestus* and *Polygonum serrulatum*, while bushes of *Cluytia natalensis* are common round the wet margins.

The summit of the plateau presents the appearance of a large flat covered with short grass. Nowhere is there the same luxuriance of grass-growth as in the valley and on the slopes, and bush of any description is quite absent. The low grass-formation is due chiefly, I consider, to the amount of grazing by cattle, sheep, and goats, and also to the fact that the tall grasses found at the lower levels are absent on the summit, their place being taken by *Aristida adscensionis*, *Elionurus argenteus*, *Digitaria monodactyla*, and *Andropogon contortus*. It is very possible that the more succulent grasses have been destroyed on the plateau by overstocking, leaving the coarse grasses in possession. I might mention that very few, if any, cattle are allowed to graze on the lower slopes in summer, owing to the difficulty of keeping them from damaging the crops. Among the plants gathered on the plateau were *Lobelia* (*Metzleria dregeana*), *Rhynchosia Totta*, *Venidium arctotoides*, *Alchemilla Woodii*, *Dicoma anomala*, *Crassula basutica*, etc. The damp banks of streams and pools were the habitats of hydrophilous plants such as *Polygonum* spp., *Rumex* spp., *Salvia repens*, *Helichrysum simillimum*, *Xyris capensis*, *Utricularia* spp., *Limosella major*, *Ranunculus Meyeri*, and numerous *Cyperaceae*.

Qoqolosi Peak carries a different formation from that of the surrounding plain. As the peak is ascended the grasses disappear and their place is taken by succulent plants, plants of a dwarf habit, and small shrubs. The succulent plants were mostly species of *Crassula*; *Lotononis Woodii*, *Melolobium adenodes*, *Heliophila basutica* (Pl. V, fig. 1) were typical of the dwarf plants; *Anthospermum pumilum*, *Sutera aspalanthoides*, *S. pristisepala*, *Melolobium microphyllum* were representative of the stunted bush.

Among the plants which go to make up a plant community we may expect to find plants of very diverse habit and form, and the flora of Leribe is no exception to this when the individual species are studied. The conditions under which plants live is the dominating factor in determining their form, so that it is not surprising to find that nearly all the species, with the exception of those inhabiting the damp shady ravines, exhibit marked xerophytic characters, and many, especially from the higher altitudes, assume a sub-alpine habit. (See Pls. V, VI.)

Annual plants as *Cotula anthemoides*, *Arctotis stoechadifolia*, *Ursinia annua*, *Sebaea exigua* and *Exochaenium grande*, which spring up after the summer rains have commenced, are not numerous. The majority of the species are perennials, and exhibit various devices whereby they are enabled to withstand the extreme drought during the winter months from June to September, when less than 2 in. of rain falls for that period. Plants with long tap-roots, thick tuberous roots, and underground woody stems, are common. *Sonchus nanus*, *Ipomoea simplex*, *Arthrosolen gymnostachys*, *Lotononis basutica*, and *Argyrolobium* spp. may be taken as typical of the tap-rooted plants. *Senecio erubescens*, *S. serra*, *Helichrysum undatum* var. *pallidum*, *H. latifolium*, *Gerbera piloselloides*, *G. viridifolia* have many thick roots. *Helichrysum platypterum*, *H. psilolepis*, *Othonna natalensis*, and *Crepis polyodon* (Pl. VI, fig. 3) are representative of plants with woody underground stems. A few plants, such as *Brachystelma foetidum* and several *Orchidaceae*, possess underground tubers. Under this category must also be mentioned a number of Monocotyledons with underground bulbs and corms. Plants with a tufted habit forming cushions are not numerous; the two most typical representatives of this form are *Gazania armerioides* and *Psammotropha androsacea* (Pl. V, fig. 2). Prostrate plants are represented by *Helichrysum ericaefolium* var. *albidulum*, *H. caespititium*, *H. chinospaerum* (Pl. VI, fig. 4), *H. Randii* (Pl. VI, fig. 2), *Lightfootia denticulata*, *Lobelia dregeana*, *Ursinia montana*, *Herniaria hirsuta*, *Argyrolobium nanum*, etc. The prostrate creepers met with were *Convolvulus capensis* var. *plicata*, *C. ulosepalus*, *Ipomoea oblongata* var. *hirsuta*, and *Dicoma anomala*. The principal climbers noted were *Clematis brachiata*, *Rhoicissus* (*Cissus cuneifolia*), *Cynanchum virens*, and *Riocreuxia picta*. *Sarcostemma viminale* and *Helichrysum Sutherlandi* were the only two pendent species met with. They were both growing on cliff faces and hanging down in festoons. Succulent plants constitute a very small percentage of the flora both in species and in individuals. *Cotyledon orbiculata* may perhaps form an exception to the latter statement, as

near the cliffs at the entrance of the large ravine between the Mission Station and Jonathan's village the writer came across a large area on which this species was growing. The other succulent plants noted were *Mesembrianthemum* spp., *Crassula* spp., *Aloe* spp., *Bulbine* spp., and *Stapelia flavirostris*. Many plants only possess radical leaves which lie more or less flat on the ground. Some of these recorded were *Wahlenbergia androsacea*, *Berkheya* (*Stoebea aristosa*), *Haplocarpha scaposa*, *Gerbera piloselloides*, *G. viridifolia*, *Sonchus nanus*, *Chironia palustris*, *Manulea crassifolia* and *Crabbea hirsuta*. For species with the habit of trees or bush the reader is referred to the enumeration of plants found in the ravines, with the addition of *Printzia pyrifolia*, *Osteospermum moniliferum*, *Rhus* spp., *Buddleia salvifolia*, *Halleria lucida*, and *Lycium* spp., which form bushes from 4-8 ft. high.

The leaves exhibit xerophytic characters in various ways and degrees. In indumentum all stages from a pubescent to a woolly leaf are met with. Plants with leaves woolly on both surfaces are *Senecio macrosperrum*, *Helichrysum callicomum*, *H. cephaloideum*, *H. psilolepis*, *H. aureo-nitens*, *H. calocephalum* (Pl. VI, fig. 1), *H. adenocarpum*, *Leontonyx squarrosus*, *Sopubia cana*, etc. *Helichrysum Mundii*, *H. latifolium*, *H. undatum* var., *Pentzia pyrifolia*, *Berkheya Kuntzii*, *B. onopordifolia*, *B. montana*, *B. alba*, *Chilianthus corrugatus*, *Stachys rugosa* var. have leaves woolly on the under-surface only. In *Gerbera piloselloides*, *Mentha longifolia* sub-sp. *capensis*, *Argyrolobium nanum*, *Lotononis basutica*, etc., the leaves are hairy and not woolly. *Solanum indicum* and *S. tomentosum* have tomentose leaves. The only plants with glandular leaves are *Sutera pristisepala*, *Drosera burkeana*, and *D. ramentacea* var. Scabrid-leaf plants were more frequent and were represented by *Striga lutea*, *S. elegans*, *S. Thunbergii*, *Melasma basuticum*, and *Verbena venosa*. The amount of leaf-surface developed shows the same great range of variation, viz. from reduced leaves in *Wahlenbergia denudata* and *Harveya* spp. to the broad leaves of typical mesophytes found in the ravines. Ericoid leaves were the most common, and were noted in *Helichrysum athrixifolium*, *H. rugulosum*, *H. squarrosum*, *Pentzia virgata*, *Athrixia elata*, *Metalsia muricata*, *Stoebe cineraria*, *Eriocephalus punctulatus*, *Wahlenbergia depressa*, *Lightfootia denticulata*, *Lobelia decipiens*, and *Passerina ericoides*. In *Gazania armerioides* the leaves are involute; in *Sutera atropurpurea*, *Selago longipedicellata*, and *Walafrida densiflora* the leaves are small and fascicled. Among the plants which develop thorns may be mentioned *Lycium* spp., *Solanum* spp., *Asparagus* spp., and *Celastrus* (*Gymnosporia*) *buxifolius*.

All the parasitic plants found belong to the *Scrophulariaceae*.



There were 4 species of *Harveya*, 4 species of *Striga*, and 2 species of *Melasma*. Insectivorous plants were represented by 2 species of *Utricularia* and 2 species of *Drosera*.

I should not consider this a floral region of great beauty where the size and colouring of the flowers are concerned. This conclusion has been arrived at from a study of the flowers of the various species, and from an attempt to group them (excluding the *Cyperaceae* and *Gramineae*) into the following three Classes,\* viz.:

I. Large, gaily-coloured flowers, or when a number of small flowers are grouped in large and conspicuous heads.

II. Medium-sized flowers.

III. Inconspicuous flowers.

Class I. (*e.g.* *Brunsvigia*, *Ipomoea*, *Gladiolus*, etc.), approximately 46 per cent.

Class II. (*e.g.* *Ranunculus*, *Silene*, *Erica*, *Sutera*, etc.), approximately 46 per cent.

Class III. (*e.g.* *Rhus*, *Celastrus*, *Phytolacca*, etc.), approximately 8 per cent.

The great bulk of the species produce dry fruits, either dehiscent or indehiscent; fleshy fruits are only found in less than 5 per cent. of the total number of species. The dry dehiscent and dry indehiscent fruits are represented in about equal proportions. The *Compositae*, *Gramineae*, *Cyperaceae*, etc., are the largest representatives of the latter group (included among these are those fruits such as are found in the *Umbelliferae* and *Labiatae* which split up into one-seeded portions), while the *Liliaceae*, *Leguminosae*, *Orchidaceae*, *Scrophulariaceae*, etc., contain the largest number of species which produce the former type of fruit. It is not within the province of this paper to go into any further details regarding the fruit and seeds; it will suffice to mention that such forms of fruit as (i) hairy fruits (*e.g.* *Clematis*, *Compositae*), (ii) Spiny fruits (*e.g.* some *Boraginaceae*), (iii) winged fruits (*e.g.* *Rumex*) are met with. Hairy seeds occur in the *Asclepiadaceae*, *Salix*, and *Eriospermum*; winged seeds in many of the Monocotyledons (*e.g.* *Gladiolus*, *Urginea*, etc.).

#### NATIVE NAMES AND USES OF PLANTS.

In an interesting paper † on "Zulu Medicine and Medicine-Men," the author in the Introduction states: "It is by no means an

\* O. Stapf, "The Flora of Kinabalu," 'Trans. Linn. Soc.' ser. 2, vol. iv, 1894.

† Rev. Alfred Bryant, "Zulu Medicine and Medicine-Men," 'Annals of the Natal Government Museum,' ii, 1 (1909).

exaggeration to affirm that comparatively the average Zulu can boast of a larger share of pure scientific knowledge than the average European." This statement applies with equal force to the natives of Basutoland.

As the reader will observe in the following list of plants, all the species collected in Basutoland by Madame Dieterlen and the author have Sesuto names. In the majority of cases each species has a name of its own by which it is distinguished from closely allied species or from plants with a similar appearance, but, as for example in the *Juncaceae*, *Cyperaceae* and *Orchidaceae*, there is usually but one "generic" name which includes all the species of the particular orders. The natives like the pre-Linnean botanists, in many cases express the name in a short sentence, using as a basis either the particular habit of the plant when it presents any striking feature, such as the development of thorns, excessive hairiness, etc., or its use when it possesses any medicinal or economic value. It is difficult to translate into English many of the Sesuto names, and in all cases a literal translation is given. Where "meaning unknown" appears after a Sesuto name it indicates that the natives can give no reason for the plant being so called, not that they do not know it.

All the particulars as to the uses the plants are put to have been given me by Madame Dieterlen, who has had a unique opportunity, during her nineteen years' residence at Leribe, of obtaining such information. The reader will notice that no mention is made of the uses of many of the plants, and this means that the natives from whom Madame Dieterlen obtained her information either did not know of any use the particular plant was put to, or would not tell, fearing that they might be imparting valuable secrets.

In a great many instances, when a native doctor is called to attend a patient, he first consults his divining-bones to find out the cause of the ailment, and after satisfying himself on this point, reconsults them to find out the particular medicine to be administered.

The Basutos, like other South African natives, are great believers in witch-craft, and they are firmly convinced that most of their ailments are due to the evil influence of some person who may be even living at a distance. To avert such evil influences or to break their spell when they are at work, the natives employ divers "medicines" and charms. These are administered in various ways, as decoctions, lotions, powders, etc., or sprinkled in the huts or on their persons, burnt in their courtyard, etc., as charms. The "medicines" prepared from various plants are supposed to turn away lightning, bring rain, or increase their crops, and there are few things in their

daily life that cannot be affected, either for good or ill, by a particular preparation from a plant or plants.

#### ALIEN FLORA.

There is a considerable alien flora at Leribe, consisting of 48 species spread over 38 genera and 18 Orders. Most of the species are now widely spread over South Africa. The plants mentioned in the list below have not been included in the Leribe flora on the following pages :

##### *Papaveraceae.*

*Argemone mexicana*, Linn.

##### *Cruciferae.*

*Brassica pachypoda*, Thellung,  
var.

*Lepidium Schinzii*, Thellung.

*Nasturtium officinale*, R. Br.

##### *Caryophyllaceae.*

*Stellaria media*, Vill.

*Spergula arvensis*, Linn.

##### *Malvaceae.*

*Malva parviflora*, Linn.

*M. verticillata*, Linn.

##### *Zygophyllaceae.*

*Tribulus terrestris*, Linn.

##### *Geraniaceae.*

*Erodium cicutarium*, L'Her.

##### *Leguminosae.*

*Medicago laciniata*, All.

*Phaseolus Mungo*, Linn.

##### *Onagraceae.*

*Epilobium hirsutum*, Linn.

*E. tetragonum*, Linn.

*Oenothera biennis*, Linn.

*Oe. tetrapetala*, Cav.

*Oe. villosa*, Thunb.

##### *Compositae.*

*Erigeron canadense*, Linn.

*Gnaphalium luteo-album*, Linn.

*Xanthium spinosum*, Linn.

*Bidens leucantha*, Willd.

*Senecio vulgaris*, Linn.

*Cnicus lanceolatus*, Willd.

*Sonchus oleraceus*, Linn.

##### *Solanaceae.*

*Solanum nigrum*, Linn.

*Physalis peruviana*, Linn.

*Nicandra physaloides*, Gaertn.

*Datura stramonium*, Linn.

*Nicotiana glauca*, R. Graham.

*N. rustica*, Linn.

##### *Scrophulariaceae.*

*Vernonia anagallis*, Linn.

##### *Labiatae.*

*Mentha aquatica*, Linn.

##### *Amarantaceae.*

*Amaranthus paniculatus*, Linn.

*Achyranthes aspera*, Linn.

##### *Chenopodiaceae.*

*Chenopodium ambrosioides*, Linn.

*C. murale*, Linn.

*C. album*, Linn.

*C. foetidum*, Schrad.

*Roubieva multifida*, Moq.

##### *Polygonaceae.*

*Polygonum aviculare*, Linn.

*P. lapathifolium* sub-sp. macu-  
latum, Dyer & Trim.

*Rumex Acetosella*, Linn.

*Euphorbiaceae.*

Euphorbia Peplus, Linn.

*Urticaceae.*

Cannabis sativa, Linn.

*Gramineae.*

Poa annua, Linn.

Bromus unioloides, H.B.K.

Hordeum secalinum, Schreb.

Zea Mais, Linn. (cultivated).

THE SYSTEMATIC CONSTITUENTS OF THE FLORA.

The following list deals only with the area discussed in the previous pages, and unlike most lists of this nature, which after all are only approximate to the truth, it may be accepted as representing the true composition of the flora of the Leribe plateau and its environs. I do not think there is a single species of Phanerogams or Ferns from this locality that has not been collected by Madame Dieterlen.

	Orders.	Genera.	Species.
Cryptogamia vasculares	—	19	33
Phanerogamia.			
Dicotyledons . . .	64	220	478
Monocotyledons . . .	13	109	271
	—	—	—
Total (Phanerogams)	77	329	749
Proportion of Monocotyledons to Dicotyledons			1 : 1·76
Proportion of genera to species			1 : 2·27

Orders.	No. of species.	Percentage of total.
1. Compositae . . .	144	19·22
2. Gramineae . . .	87	11·61
3. Cyperaceae . . .	53	7·20
4. Liliaceae . . .	52	7·07
5. Scrophulariaceae . . .	42	5·59
6. Leguminosae . . .	39	5·20
7. Asclepiadaceae . . .	27	3·60
8. Orchidaceae . . .	25	3·33
9. Amaryllidaceae . . .	20	2·80
10. Crassulaceae . . .	17	2·40
11. Iridaceae . . .	17	2·40
12. Campanulaceae . . .	14	1·87
13. Rubiaceae . . .	14	1·87
14. Geraniaceae . . .	13	1·74
15. Cruciferae . . .	12	1·60
16. Anacardiaceae . . .	10	1·33
17. Labiatae . . .	10	1·33

Orders.	No. of species.	Percentage of total.
18. Umbelliferae . . .	9 . . .	1.20
19. Juncaceae . . .	8 . . .	1.06
20. Solanaceae . . .	8 . . .	1.06

The following are the remaining Orders arranged according to the number of species in each: Boraginaceae, Convolvulaceae, Ficoideae, Rosaceae, Santalaceae (7); Euphorbiaceae, Malvaceae, Polygalaceae, Polygonaceae, Ranunculaceae, Sterculiaceae (6); Cucurbitaceae, Ericaceae, Gentianaceae, Thymelaeaceae (5); Caryophyllaceae, Ebenaceae, Selaginaceae (4); Amarantaceae, Commelinaceae, Urticaceae (3); Acanthaceae, Aroideae, Celastraceae, Dipsacae, Droseraceae, Hypericaceae, Illecebraceae, Lentibulariaceae, Loganiaceae, Portulacaceae, Salicaceae (2); Ampelideae, Araliaceae, Bixineae, Cappariaceae, Eriocaulaceae, Halogoraceae, Linaceae, Menispermaceae, Myricaceae, Myrsineae, Naiadaceae, Olacinaceae, Oleaceae, Onagraceae, Papaveraceae, Pittosporaceae, Proteaceae, Resedaceae, Restiaceae, Rhamnaceae, Valeriaceae, Verbenaceae, Xyridaceae (1).

The following are the largest genera: *Helichrysum* (30 species), *Senecio* (21), *Crassula* (13), *Andropogon*, *Cyperus*, *Hypoxis* (11), *Lotononis*, *Rhus* (10), *Eragrostis* (9), *Bulbostylis*, *Juncus*, *Schizoglossum*, *Scilla*, *Scirpus*, *Wahlenbergia* (7), *Asclepias*, *Asparagus*, *Digitaria*, *Gladiolus*, *Solanum*, *Sutera*, *Thesium* (6).

There are 189 genera represented by one species only.

### III. THE EASTERN MOUNTAIN REGION.

All writers on the phyto-geography of South Africa, despite the divergence of their views as to the subdivisions of South Africa into botanical regions, have agreed in including Basutoland in a region generally termed the "Kalahari Region," the limits of which vary according to their individual ideas.\* Thus Thode† includes the S.W. Protectorate, Bechuanaland, the Orange Free State, Basutoland, the Transvaal Hoogetveldt (south of the 26th parallel), and parts of the N.E. Districts of the Cape Province in his "Kalahari Territory"; Marloth‡ defines a region which he calls the "High Veldt," and while

\* The reader should refer to a paper by R. Marloth ("Wissenschaftliche ergebnisse der Deutschen Tiefsee-Expedition auf dem Dampfer, 'Valdivia,'" 1898-1899, ii, 3, Pls. 4 and 5), where a set of instructive maps is given showing the historical development of South African Phyto-Geography.

† Justus Thode, 'The Botanical Regions of Natal, determined by Altitude,' Durban, 1901.

‡ R. Marloth, "The Phyto-Geographical Subdivisions of South Africa," 'Report of the Brit. Assoc. Adv. Sc.,' Cape Town, 1905.



excluding much which comprises the "Kalahari Region" of Thode, agrees so far as to include Basutoland. Marloth however notes that "In the eastern parts the country is mountainous, and the vegetation consequently more varied." Bolus,\* whose paper is the classic on South African Phyto-Geography, states in the introduction to the "Kalahari Region": "It must at once be stated that this vast region is as yet so imperfectly explored as to its physical divisions, its aspect, its climate, and the systematic constituents of its vegetation, that it is impossible at present to do more than offer a very general view of a country which will need many years of study, and which will hereafter almost certainly require to be divided into several Regions or, at least, to be subdivided into Provinces."

As now treated it is bounded on the west by the still less explored Western Region, on the south by the Upper Region, on the south-east and east by the mountains of the South-Eastern Coast Region, on the north by the great Tropical Region, which is beyond the scope of our inquiry.

It thus includes :

1. The higher eastern mountain country, forming parts of Cape Colony, Natal, and Basutoland, with an altitude higher than 3500 or 4000 ft. (This, in our view, will probably hereafter require separation as a Region or Province.)

2. Almost the whole of the Orange River Colony, of the Transvaal, and Bechuanaland.

I quote the above in full, as Bolus was the first to realise the mistake of including Basutoland and parts of the surrounding country with the major portion of the Orange Free State, the Transvaal, and Bechuanaland. He was however unable to follow up his view owing to the lack of sufficient material. In the 'Flora Capensis,' the standard work on South African Systematic Botany, Basutoland is also included in a Kalahari Region almost identical with that of Bolus.

It is a portion of the first part of Bolus' "Kalahari Region" that is dealt with in this paper.

#### OROGRAPHY.

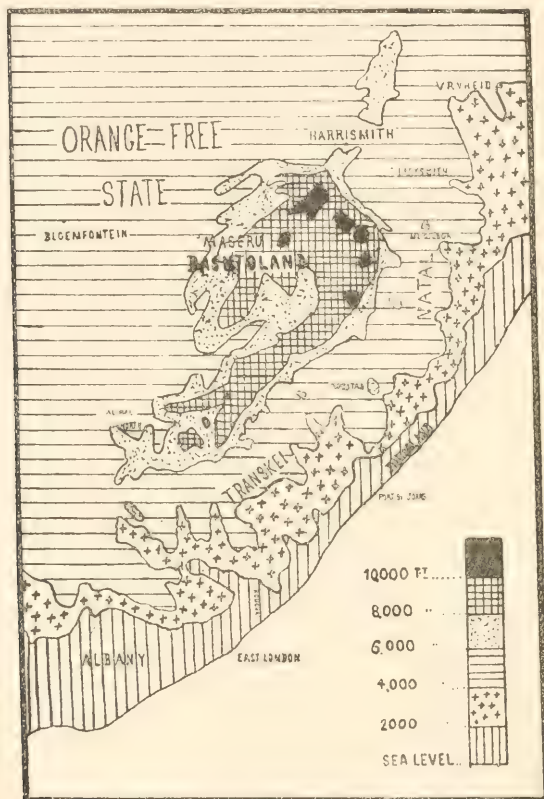
The Eastern Mountain Region, as the writer has limited it for the present, is a large tract of country lying between the 28th and 30th degree of latitude, and at its widest limits extending from the 27th degree of longitude on the west to about midway between the

\* H. Bolus, "Sketch of the Floral Regions of South Africa," 'Science in South Africa,' 1905.



29th and 30th degree in the east; both at its northern and southern extremities it becomes narrower. A glance at the map will show that it has a well-defined natural boundary on the west in the shape of a continuous range of mountains running almost parallel with the Caledon River (Pl. VII). The change in the flora westward

FIG. 2.



points to the above mountain-range being almost a true floral boundary. The southern limits of this region I have provisionally regarded to be the Wittebergen, which separates Basutoland from Barkly East, though I am led to believe from a study of what is known of the flora of Aliwal North, Wodehouse, and Barkly East, that when these districts are better explored botanically, the Stormberg Range will prove to be the southern boundary. On the east the boundary line follows the contour of the Drakensbergen at an altitude of about 5000 ft., below

which the flora assumes a different character. The Natal portion of the Eastern Mountain Region would correspond to Thode's "Mountain Region."\* The northern portion of our Region converges on the Drakensbergen and does not exceed 50 miles in breadth. I have not extended my enquiries in detail beyond the 28th parallel, though Bolus extended this region northward as a narrow strip, as far as Barberton.

The Eastern Mountain Region as defined above then includes the whole of Basutoland, a strip of the Orange Free State from Nelson's Kop on the north to the Orange River on the south, which forms a rough horse-shoe, a small portion of the Cape Province on the south, and a portion of East Griqualand and Natal bordering the Drakensbergen. This area forms a well-defined elevated table-land above 5000 ft. in altitude on its outermost limits, with a general elevation of 8000 ft. in the greater part of Basutoland, and rising to peaks 10,000 ft. and over on the Drakensbergen (see fig. 3).

Basutoland, which forms the major portion of the Eastern Mountain Region, is a great tract of high country, 10,300 square miles in area, of which the Drakensbergen is the south-eastern edge. The top of the Drakensbergen slopes gently westwards, and the sloping ground is covered with grass, heather, bog, and rocks; all the cliffs are on the Natal side. A long range of mountains, the Maluti Mountains, traverses Basutoland in a south-westerly direction, but throughout the country is mountainous and in some parts difficult of access.

#### GEOLOGY.

For a more detailed account of the geology the reader is referred to papers by Dr. A. L. du Toit† and Mr. F. F. Churchill,‡ from which the following has been extracted.

The whole of Basutoland is built up of Stormberg beds divided up as follows in descending orders (see fig. 3).§

4. Volcanic beds.
3. Cave Sandstone.
2. Red beds.
1. Molteno beds.

1. **MOLTENO BEDS.**—This formation crops out over flattish ground

\* Thode, *loc. cit.*

† A. L. du Toit, "The Forming of the Drakensbergen," 'Trans. S. Afr. Philos. Soc.,' vol. xvi, 1, pp. 53-57.

‡ F. F. Churchill, "Notes on the Geology of the Drakensbergen," *loc. cit.*, vol. x, 3.

§ This sketch has kindly been drawn for me by Mr. S. H. Haughton, B.A., F.G.S.



past Mafeteng, Maseru, Tholtse, to the head of the Caledon River. The high ground to the north of Ficksburg and round Harrismith is built up of Red beds and Cave Sandstone.

3. CAVE SANDSTONE.—So called on account of the unequal weathering which causes the formation of large caves. It varies in thickness from 2-400 ft., and rests on the Red beds.

4. VOLCANIC BEDS.—Consist almost entirely of basic lavas which penetrate the sedimentary rocks. On the Natal side of the Drakensbergen the dolerite capping does not extend lower than 5900 ft. to 6100 ft. above sea-level.

The whole of these Stormberg beds rest on the Karroo beds which crop out in the Orange Free State and in the lower parts of Natal (see fig. 3). The soils derived from the Stormberg Series are very uniform in texture and fine in grain, and contain relatively large proportions of lime.\*

The reader will have noticed that both the altitude and the geological formation mark off the Eastern Mountain Region into a well-defined area.

#### METEOROLOGY.

The temperature and rainfall records from this Region are very meagre. What records I have been able to obtain are given in the following tables :

TABLE I.—*Annual Rainfall, 1901-1908.*

	Alt. in feet.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
Mafeteng	. 5600	—	—	—	21·66	26·55	25·17	37·37	22·67	26·68†
Mohalie's Hoek	—	27·22	29·74	18·94	20·85	28·72	28·19	41·30	28·02	27·87
Maseru	. 5065	29·46	32·24	23·20	23·47	30·08	30·98	39·09	21·64	24·89
Teyateyaneng.	5690	37·00	33·78	20·52	24·49	30·28	28·00	39·30	27·21	30·07
Moyeni Quth- ing	. 6000	42·81	—	22·01	24·47	37·53	—	46·12	—	34·58†
Quacha's Nek	. 6236	28·74	27·00	27·63	25·31	32·35	27·68	46·19	43·37	32·28

† Average for five years.

The only other records are for Harrismith, 25·43 inches (1905) 24·91 inches (1913), and Thaba Unchu, 19·09 inches (1904). For the rainfall at Leribe the reader is referred to a table on p. 5.

\* C. F. Juritz, "The Fertility of some Colonial Soils, as Influenced by Geological Conditions," 'Trans. S. Afr. Philos. Soc.,' vol. xviii, p. 27.



TABLE II.—*Rainfall during the six Summer Months (October–May), 1901–1908.*

	Alt. in feet.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
Mafeteng	5600	—	—	—	17·01	19·79	20·03	26·95	15·84	19·20*
Mohalie's Hoek	—	20·67	20·76	12·18	16·62	22·06	23·66	29·64	19·42	20·62
Maseru	5065	24·02	22·99	17·10	19·05	25·50	26·37	30·36	15·62	22·62
Teyateyaneng	5690	30·46	24·96	14·30	18·98	25·69	23·58	29·75	20·42	23·51
Moyeni Quthing	6000	32·54	—	14·60	18·38	29·49	—	32·63	—	25·52*
Quacha's Nek	6236	23·98	21·95	20·30	24·10	28·68	24·82	36·74	—	25·59†

\* Average for five years.

† Average for seven years.

TABLE III.—*Rainfall during the six Winter Months (April–September), 1901–1908.*

	Alt. in feet.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
Mafeteng	5600	6·77	8·01	—	4·65	6·76	5·14	10·42	6·83	6·94*
Mohalie's Hoek	—	6·55	8·98	6·76	4·23	6·66	4·53	11·66	8·60	7·24
Maseru	5065	5·44	9·25	6·10	4·42	4·58	4·61	8·73	6·02	6·14
Teyateyaneng	5690	6·54	8·82	6·22	5·51	4·59	4·42	9·55	6·79	6·63
Moyeni Quthing	6000	10·27	9·01	7·41	6·09	8·04	—	13·49	—	9·05†
Quacha's Nek	6236	4·76	5·05	7·35	1·21	3·67	2·86	12·45	10·35	5·96

\* Average for seven years.

† Average for six years.

TABLE IV.—*Rainfall during the Months of May–August, the period of Least Rainfall.*

	Alt. in feet.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
Mafeteng	5600	1·40	1·89	—	2·14	2·66	1·01	4·80	3·46	2·48*
Mohalie's Hoek	—	2·38	3·78	3·26	1·93	2·66	1·25	4·91	4·44	3·07
Maseru	5065	0·82	3·99	2·02	2·50	1·60	1·20	2·63	2·71	2·15
Teyateyaneng	5690	1·88	2·11	1·32	3·26	0·93	0·84	2·91	3·80	2·13
Moyeni Quthing	6000	4·19	5·45	3·19	2·95	3·65	—	5·87	—	4·21†
Quacha's Nek	6236	1·03	2·90	2·23	0·77	0·93	0·63	2·99	2·56	1·75

\* Average for seven years.

† Average for six years.

A reference to the above tables will show that it is a region of summer rains; over 75 per cent. of the total rainfall takes place from October to May. The average annual rainfall is about 29·39 in., which compares favourably with other parts of South Africa, except the Karroo, Upper, and certain parts of the Kalahari Regions. The rainy months are usually January–February, when severe thunderstorms often accompanied by hail, are frequent. During March and April the rainfall diminishes, and a “dry period” (May–August), during which less than 3 in. of rain are registered, intervenes between

the first rains which begin to fall about September or October. The "dry period" is not so severe as that which occurs during the corresponding months in the western part of the Kalahari, as a comparison with the Table VII on p. 25 will show.

The only temperature records available are given in the following table :

TABLE V.—*Temperature.*

	Altitude in feet.	Number of years.	Absolute maximum.	Absolute minimum.
Teyateyaneng . . .	5690	6	82·3° F.	33·9° F.
Mohalie's Hoek . . .	—	5	82·2° F.	30·5° F.
Leribe . . . . .	5210	2	83·0° F.	32·2° F.
Moyeni Quthing . . .	6000	2	82·0° F.	30·8° F.
Butha Buthe . . . .	5500	1	83·1° F.	33·6° F.

It will be seen from the few data above that the extremes of temperature are by no means great. This table should be compared with Table VIII on p. 25. The few figures give no indication of the temperature conditions on the high mountain peaks, some of which rise to 10,000 ft. or more. These peaks are among the highest found in South Africa, but none rise above the line of permanent snow, though in winter many of them are capped with snow for days or weeks at a stretch. The proper exploration of the peaks in this Region will undoubtedly yield much that is of botanical interest.

Throughout this Region frosts are of frequent occurrence on the low ground in winter.

SYSTEMATIC CONSTITUENTS OF THE FLORA.

	Orders.	Genera.	Species.
Cryptogamia Vasculares . . .	—	25	53
Phanerogamia—			
Dicotyledons . . . . .	76	319	1041
Monocotyledons . . . . .	15	147	512
Total (phanerogams)	91	466	1553
Proportion of Monocotyledons to Dicotyledons . . .			1 : 2·03
Proportion of genera to species . . . . .			1 : 3·33

*Predominating Orders.*

	Number of species.	Percentage of the whole.
1. Compositae . . . . .	286	18·05
2. Gramineae . . . . .	146	9·21
3. Liliaceae . . . . .	101	6·37
4. Leguminosae . . . . .	95	5·99

	Number of species.	Percentage of the whole.
5. Orchidaceae . . .	89	5·61
6. Scrophulariaceae . .	86	5·42
7. Cyperaceae . . .	75	4·73
8. Asclepiadaceae . .	51	3·21
9. Amaryllidaceae . .	39	2·46
10. Iridaceae . . .	36	2·27
11. Crassulaceae . . .	35	2·20
12. Labiatae . . .	34	2·14
13. Campanulaceae . .	31	1·95
14. Geraniaceae . . .	29	1·83
15. Selaginaceae . . .	29	1·83
16. Gentianaceae . . .	21	1·32
17. Umbelliferae . . .	21	1·32
18. Cruciferae . . .	20	1·26
19. Ericaceae . . .	20	1·26
20. Rubiaceae . . .	20	1·26
21. Ficoideae . . .	18	1·13

The following are the remaining Orders arranged according to the number of species in each: Polygalaceae (15); Anacardiaceae, Boraginaceae, Convolvulaceae (13); Rosaceae, Solanaceae (12); Malvaceae, Ranunculaceae (11); Polygonaceae, Thymelaeaceae (10); Caryophyllaceae, Cucurbitaceae, Ebenaceae, Euphorbiaceae, Sterculiaceae (9); Acanthaceae, Juncaceae, Santalaceae (8); Onagraceae (7); Amarantaceae (6); Chenopodiaceae, Proteaceae, Verbenaceae (5); Celastraceae, Dipsaceae, Naiadaceae, Urticaceae (4); Aroideae, Commelinaceae, Eriocaulaceae, Lentibulariaceae, Loganiaceae, Oleaceae, Papaveraceae, Portulacaceae, Tiliaceae (3); Dioscoreaceae, Droseraceae, Gesneriaceae, Hypericinaceae, Halogoraceae, Illecebraceae, Lythraceae, Sapindaceae (2); Ampelideae, Apocynaceae, Araliaceae, Bixineae, Capparideae, Hydrocharideae, Illicineae, Lineae, Menispermaceae, Myricaceae, Myrsinaceae, Nyctaginaceae, Olacinaceae, Passifloraceae, Piperaceae, Pittosporaceae, Phytolaccaceae, Primulaceae, Resedaceae, Restiaceae, Rhamnaceae, Salicaceae, Saxifragaceae, Valerianeae, Xyrideae, Zygophyllaceae (1).

The following are the largest genera: *Helichrysum* (61 species); *Senecio* (56); *Crassula* (30); *Erica*, *Sutera* (18); *Disa*, *Lotononis* (17); *Sebaea* (16); *Andropogon*, *Hypoxis* (15); *Kniphofia*, *Selago* (14); *Argyrolobium*, *Cyperus*, *Eragrostis*, *Eulophia*, *Gladiolus*, *Schizoglossum*, *Wahlenbergia* (13); *Berkheya*, *Euryops*, *Habenaria*, *Indigofera*, *Pelargonium*, *Rhus*, *Zaluzianskya* (12).

Among the Phanerogams enumerated in the list there are 273 species (17·23 per cent. of the total Phanerogamic flora) endemic.

The more important orders, of which more than 20 per cent. of the species are endemic, are as follows :

Order.	Number of species.	Number of endemic species.	Percentage.
Selaginaceae .	29	12	41·3
Ericaceae .	20	6	30·0
Campanulaceae .	31	8	25·8
Compositae .	286	74	25·8
Crassulaceae .	35	9	25·7
Leguminosae .	95	24	25·2
Gentianaceae .	21	5	23·8
Liliaceae .	101	23	22·7
Orchidaceae .	89	20	22·4
Scrophulariaceae .	86	19	22·0

The more important genera, of which more than 20 per cent. of the species are endemic, are as follows :

Genus.	Number of species.	Number of endemic species.	Percentage.
Berkheya .	12	7	58·3
Lotononis .	17	9	52·9
Disperis .	10	5	50·0
Euryops .	12	6	50·0
Hebenstreitia .	10	5	50·0
Kniphofia .	14	7	50·0
Zaluzianskya .	12	6	50·0
Wahlenbergia .	13	6	46·1
Stachys .	11	5	45·5
Alepidea .	9	4	44·4
Selago .	14	6	42·8
Erica .	18	6	33·3
Sebaea .	16	5	31·2
Crassula .	30	9	30·0
Helichrysum .	61	18	29·5
Sutera .	18	5	27·7
Senecio .	56	12	21·4

#### IV. THE KALAHARI FLORA.

To arrive at the composition and the affinities of the flora of the Eastern Mountain Region it has been necessary to draw up fresh lists of the species occurring in the Kalahari and South-Eastern Regions,

as for our purpose the lists given by Bolus are useless for comparison, for the reason, as I have pointed out above, that he included East Griqualand, Basutoland, etc., in his Kalahari Region, and the former also in the South-Eastern Region. These fresh lists have been compiled from the collections in the South African Museum and the Bolus herbaria, and from records given in the 'Flora Capensis.' Bolus was conscious of the heterogeneous nature of his Kalahari Region, as he states it "will hereafter almost certainly require to be divided into several Regions, or at least to be subdivided into Provinces." From an examination of collections made in the Transvaal round Houtbosch (and Pietersburg) and Barberton (above 4000 ft.), I also support this view, though I think Bolus was wrong in including Barberton in his proposed Eastern Mountain Region. Unfortunately I have not been able to examine sufficiently large collections from these localities to make any definite statement as to the true affinities of the floras, but from the data brought together I have no hesitation in saying that they cannot be included in the Kalahari Region. This being my view, I have excluded from the Kalahari Region as understood in this paper, all species which occur in the neighbourhood of the high mountain range forming the northern continuation of the Drakensbergen.

The following reasons have led me to adopt this view :

1. The presence of at least 7 species of *Ericaceae* in these regions, viz., *Erica alopecurus*, Harv., *E. alticola*, G. & B., *E. Atherstonei*, Diels., *E. cerinthoides*, Linn., *E. drakensbergensis*, G. & B., *E. subverticillaris*, Diels., and *E. Woodii*, Bolus.

2. The presence of a large orchid flora. From Barberton 30 species have been recorded, and from Houtbosch and Pietersburg 44 species. The Kalahari Region contains 27 species of *Orchidaceae*, of which only 7 species are common to either Barberton or Houtbosch. The presence of epiphytic orchids is also significant. *Megaclinium Sandersoni*, Oliv., *Angraecum sacciferum*, Lindl., and *A. pusillum*, Lindl., occur at Barberton: *Angraecum sacciferum*, Lindl., and *A. tricuspe*, Bolus, at Houtbosch.

3. The paucity of species of *Asclepiadaceae*. This important order of the Kalahari Region, which ranks fourth (with 119 species) among the predominant Orders, is as far as my information goes, only represented at Barberton by 16 species and at Houtbosch by 12 species. This paucity of species is also very noticeable in the *Acanthaceae* and *Convolvulaceae*, both of which are characteristic Orders of the Kalahari Region.

It is probable that when the floras of Barberton and Houtbosch are



better known they will prove to be rich in species which do not occur in the Kalahari Region, as I find from the small collections examined viz., 332 species from Barberton, and 424 species from Houtbosch and Pietersburg, 49·09 per cent. of the former and 50·47 per cent. of the latter have not been recorded from the Kalahari Region.

METEOROLOGY.

TABLE VI.—*Rainfall, Kalahari Region.\**

	Altitude in feet.	Mean annual fall for ten years.	Mean fall during six winter months.	Mean fall during six summer months.
Upington . . .	2800	8·67	2·24	6·43
Prieska . . .	3300	11·41	3·07	8·34
Kimberley . . .	4042	20·44	4·62	15·82
Vryburg . . .	4300	25·50	3·85	21·65
Mafeking . . .	4194	26·98	3·57	23·41
Pretoria . . .	4471	26·66	—	—
Johannesburg . .	5735	30·26	4·56	25·70
Bloemfontein . .	4510	25·39	6·57	18·82

\* Ex Bolus.

TABLE VII.—*Rainfall during the Months of May–August, the Period of Least Rainfall.*

	Alt.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Mean.
Upington . . .	2800	0·00	0·18	0·05	0·20	0·45	1·46	0·52	0·87	0·46
Prieska . . .	3300	0·11	0·00	0·15	0·49	1·27	1·86	1·59	3·35	1·10
Griquatown . .	3560	0·23	0·70	0·50	0·18	0·92	1·35	1·81	1·32	0·87
Douglas . . .	3500	0·22	0·79	0·34	0·33	1·22	1·49	2·13	1·13	0·96
Kimberley . . .	4042	0·12	0·93	0·95	0·54	0·42	0·82	1·04	1·75	0·87
Vryburg . . .	4300	0·45	0·67	0·95	0·19	0·26	0·04	1·56	1·35	0·68
Bloemfontein . .	4510	—	—	2·06	1·59	0·67	0·67	—	2·61	0·94*

\* Average for five years.

TABLE VIII.—*Temperature, Kalahari Region.\**

	Alt. metres.	Number of years.	Absolute maximum.	Absolute minimum.
Kenhardt . . .	830	6	112·0° F.	20·0° F.
Prieska . . .	1015	1	105·8° F.	25·0° F.
Kimberley . . .	1243	12	107·2° F.	21·5° F.
Johannesburg . .	1764	5	96·0° F.	21·0° F.
Kroonstad . . .	1384	1	105·8° F.	25·0° F.
Bloemfontein . .	1387	12	109·0° F.	16·0° F.

\* Ex Bolus.

These tables should be compared with those under the Eastern Mountain Region. The extreme drought, lasting from May to August, and the greater extremes of temperature are the outstanding differences.

## SYSTEMATIC CONSTITUENTS OF THE FLORA.

	Orders.	Genera.	Species.
Dicotyledons . . .	95 .	540 .	1752
Monocotyledons . . .	16 .	129 .	443
Total . . .	111 .	669 .	2195
Proportion of Monocotyledons to Dicotyledons			1 : 3·95
Proportion of genera to species			1 : 3·28

*Predominating Orders.*

	Number of species.	Percentage of the whole.
1. Compositae . . .	257 .	11·70
2. Leguminosae . . .	255 .	11·70
3. Gramineae . . .	140 .	6·37
4. Asclepiadaceae . . .	119 .	5·42
5. Liliaceae . . .	104 .	4·73
6. Scrophulariaceae . . .	95 .	4·32
7. Acanthaceae . . .	77 .	3·50
8. Cyperaceae . . .	63 .	2·87
9. Labiatae . . .	57 .	2·59
10. Convolvulaceae . . .	55 .	2·50
11. Rubiaceae . . .	49 .	2·23
12. Sterculiaceae . . .	49 .	2·23
13. Euphorbiaceae . . .	45 .	2·05
14. Iridaceae . . .	42 .	1·91
15. Ficoideae . . .	41 .	1·86
16. Malvaceae . . .	30 .	1·37
17. Amaryllidaceae . . .	29 .	1·33
18. Anacardiaceae . . .	28 .	1·27
19. Amarantaceae . . .	28 .	1·27
20. Orchidaceae . . .	27 .	1·23
21. Verbenaceae . . .	27 .	1·23
22. Tiliaceae . . .	25 .	1·13
23. Cucurbitaceae . . .	24 .	1·09
24. Polygonaceae . . .	22 .	1·00
25. Selaginiae . . .	22 .	1·00

The following are the largest genera: Indigofera (48 species); Helichrysum (45); Senecio (36); Ipomoea (31); Hermannia (29); Sutura (27); Acacia (26); Rhynchosia (24); Asclepias, Eragrostis (23); Rhus, Tephrosia (21); Blepharis, Schizoglossum (20); Cro-tallaria, Mesembrianthemum (19); Cyperus (18); Andropogon (17);

*Aristida* (15); *Gladiolus*, *Ocimum* (14); *Grewia*, *Lotononis*, *Vernonia* (13); *Anthericum*, *Barleria*, *Convolvulus*, *Panicum*, *Sebaea*, *Selago* (12).

# V. COMPARISON OF THE KALAHARI AND EASTERN MOUNTAIN FLORAS.\*

1. Orders occurring in the Kalahari which are not recorded from the Eastern Mountain Region :

Nymphaeaceae, Elatineae, Ochnaceae, Connaraceae, Hamamelideae, Rhizophoraceae, Lemnaceae, Myrtaceae, Loasaceae, Plumbaginaceae, Pontederiaceae (each represented by one species); Malpighiaceae, Burseraceae (each represented by 2 genera and 3 species); Tuneraceae (2 genera and 2 species); Combretaceae (2 genera and 13 species); Sapotaceae (3 genera and 5 species); Rutaceae (5 genera and 6 species); Pedalineae (5 genera and 9 species); Bignoniaceae (1 genus and 3 species); Plantagineae (2 genera and 2 species); Loranthaceae (2 genera and 5 species); Haemadoracea (2 genera and 3 species).

The most striking feature to be noted is the absence of the Combretaceae and the Pedalineae, which are characteristic Kalahari Orders.

2. Orders occurring in the Eastern Mountain Region which are not recorded from the Kalahari :

Piperaceae, Restiaceae (1 genus and 1 species); Aroideae (1 genus and 3 species).

3. Orders well represented in the Kalahari, but poorly represented in the Eastern Mountain Region :

Order.	Kalahari.		Eastern Mountain Region.	
	No. of genera.	No. of species.	No. of genera.	No. of species.
Capparideae .	7	9	1	1
Malvaceae .	7	30	4	11
Sterculiaceae .	6	49	2	9
Tiliaceae .	3	25	2	3
Zygophyllaceae .	4	8	1	1
Celastraceae .	6	13	1	4
Rhamnaceae .	4	7	1	1
Ampelideae .	5	15	1	1
Leguminosae .	51	255	26	95
Lythraceae .	4	11	1	2
Cucurbitaceae .	6	24	6	9

\* See Fig. 4.

Order.	Kalahari.		Eastern Mountain Region.	
	No. of genera.	No. of species.	No. of genera.	No. of species.
Ficoideae . . .	11	41	4	18
Rubiaceae . . .	16	49	9	20
Asclepiadaceae . .	34	119	15	51
Loganiaceae . . .	5	12	3	3
Convolvulaceae . .	7	55	3	13
Acanthaceae . . .	16	77	7	8
Verbenaceae . . .	7	27	4	5
Amarantaceae . . .	14	28	4	6
Polygonaceae . . .	4	22	2	10
Euphorbiaceae . . .	15	45	3	9
Urticaceae . . .	5	14	3	4

The Capparideae, Tiliaceae, Cucurbitaceae, Convolvulaceae, and Acanthaceae are all characteristic Kalahari Orders, the rest occur commonly in other parts of South Africa, but are better represented in the Kalahari than in the Eastern Mountain Region.

4. Orders well represented in the Eastern Mountain Region, but poorly represented in the Kalahari :

Orders.	Eastern Mountain Region.		Kalahari.	
	No. of genera.	No. of species.	No. of genera.	No. of species.
Polygalaceae . . .	2	15	2	7
Geraniaceae . . .	5	29	5	18
Crassulaceae . . .	4	35	3	16
Umbelliferae . . .	11	21	8	11
Ericaceae . . .	2	20	1	1
Orchidaceae . . .	15	89	9	27

All these Orders are characteristic both of the South-Western and South-Eastern Regions. The large predominance of Ericaceae and Orchidaceae stands out as the striking difference between the Eastern Mountain Region and Kalahari floras.

5. Predominant genera in the Kalahari compared with the same genera in the Eastern Mountain Region :

Genera.	No. of spp. in K.*	No. of spp. in E.M.R.*	Genera.	No. of spp. in K.*	No. of spp. in E.M.R.*
Indigofera . . .	48	12	Hermannia . . .	29	5
Helichrysum . . .	45	61	Sutera . . .	27	18
Senecio . . .	36	56	Acacia . . .	26	1
Ipomoea. . .	31	8	Rhynchosia . . .	24	7

\* E.M.R. (Eastern Mountain Region). K. (Kalahari Region).

Genera.	No. of spp. in K.*	No. of spp. in E.M.R.*	Genera.	No. of spp. in K.*	No. of spp. in E.M.R.*
Asclepias .	23	11	Gladiolus .	14	13
Eragrostis .	23	13	Ocimum .	14	0
Rhus .	21	12	Grewia .	13	2
Tephrosia .	21	3	Lotononis .	13	17
Blepharis .	20	2	Vernonia .	13	6
Schizoglossum	20	13	Anthericum .	12	6
Crotalaria .	19	1	Barleria .	12	1
Mesembrian-			Convolvulus .	12	4
themum .	19	9	Panicum .	12	7
Cyperus .	18	13	Sebaea .	12	16
Andropogon .	17	15	Selago .	12	14
Aristida .	15	8			

\* E.M.R. (Eastern Mountain Region). K. (Kalahari Region).

The predominance of species of *Ipomoea*, *Hermannia*, *Acacia*, *Blepharis*, *Crotalaria*, *Ocimum*, *Grewia*, and *Barleria* in the Kalahari should be specially noted.

6. Predominant genera in the Eastern Mountain Region compared with the same genera in the Kalahari :

Genera.	No. of spp. in E.M.R.*	No. of spp. in K.*	Genera.	No. of spp. in E.M.R.*	No. of spp. in K.*
Helichrysum .	61	45	Cyperus .	13	18
Senecio .	56	36	Eragrostis .	13	23
Crassula .	30	7	Eulophia .	13	9
Erica .	18	1	Gladiolus .	13	14
Sutera .	18	27	Schizoglossum	13	14
Disa .	17	1	Wahlenbergia	13	8
Lotononis .	17	13	Berkheya .	12	10
Sebaea .	16	12	Euryops .	12	5
Andropogon .	15	17	Habenaria .	12	6
Hypoxis .	15	9	Indigofera .	12	48
Kniphofia .	14	3	Pelargonium .	12	7
Selago .	14	12	Rhus .	12	21
Argyrolobium	13	5	Zaluzianskya .	12	0

\* E.M.R. (Eastern Mountain Region). K. (Kalahari Region).

7. There are 423 species (or 27·19 per cent.) of the Eastern Mountain Region flora which also occur in the Kalahari, but of this number 317 species (or 20·42 per cent.) are common to the Kalahari, the Eastern Mountain Region, and the South-Eastern Region.



8. The proportion of Monocotyledons to Dicotyledons is greater in the Kalahari Region than in the Eastern Mountain Region (viz. 1 : 3·28 and 1 : 2·03 respectively) though the actual number of species is smaller.

## VI. THE SOUTH-EASTERN REGION.

The South-Eastern Region as defined by Bolus will require some alteration, as he included in this region the whole of Natal and East Griqualand, parts of which belong to the Eastern Mountain Region. Bolus himself recognises this, as he notes "the (boundary) line should keep to a contour of about 3500 ft. of altitude, above which the vege-

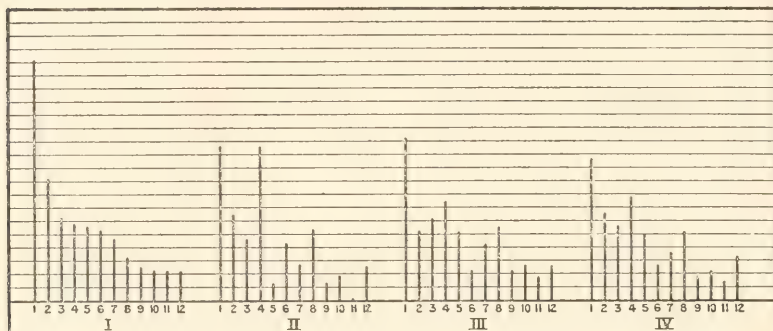


FIG. 4.—Diagrams showing the differences between the predominance of the twelve largest Orders in the following floras: I. Eastern Mountain Region. II. Kalahari Region. III. "Kaffrarian Region." IV. Natal under 4000 ft. 1. Compositae. 2. Gramineae. 3. Liliaceae. 4. Leguminosae. 5. Orchidaceae. 6. Scrophulariaceae. 7. Cyperaceae. 8. Asclepiadaceae. 9. Amaryllidaceae. 10. Iridaceae. 11. Crassulaceae. 12. Labiatae.

tation begins to assume the character of the steppes of the Kalahari Region, but no such contour-line is marked on any map." I am at present attempting to redefine the South-Eastern Region in the light of what we now know of the Eastern Mountain Region. As yet my results are incomplete, though I am led to favour the view of Thode\* that this region can be split up into three provinces. Marloth† recognised the diversity of the flora when he mapped off a "South-Eastern Coast Belt." A flora of East Griqualand, and of King Williams Town, Komgha, Pondoland, Transkei, and Tembuland (the latter group I shall now call the "Kaffrarian" flora) has been compiled for the sake of comparison with the Eastern Mountain Region. The flora of East Griqualand presents problems which make it

\* Thode, *loc. cit.*

† Marloth, *loc. cit.*

advisable to treat the subject in a separate paper, and for comparison with our Region I will only use the "Kaffrarian" flora and the flora of Natal *under* 4000 ft., above which it assumes a totally different aspect.

# VII. COMPARISON OF THE FLORAS OF THE EASTERN MOUNTAIN AND SOUTH-EASTERN REGIONS.\*

TABLE I.—*The Relative Positions of the Five Predominant Orders.*

Eastern Mountain Region.	"Kaffrarian" Region.	Natal <i>under</i> 4000 ft.
1. Compositae.	1. Compositae.	1. Compositae.
2. Gramineae.	2. Leguminosae.	2. Leguminosae.
3. Liliaceae.	3. Liliaceae.	3. Graminae.
4. Leguminosae.	4. Gramineae.	4. Liliaceae.
5. Orchidaceae.	5. Orchidaceae.	5. Orchidaceae.

The five predominant Orders are the same in each case, the Eastern Mountain Region differs from the other two floral areas in the important position taken by the grasses and the comparatively few Leguminosae. The Compositae also form a far larger percentage of the total flora than in either the Kaffrarian or Natal areas. It is only when the floras are examined more critically that the marked difference between the Eastern Mountain and the South-Eastern Regions becomes apparent, as the following table shows:

TABLE II.

Orders.	No. of spp. in E.M.R.*	No. of spp. in "K" flora.*	No. of spp. in "N" under 4000 ft.*
Capparideae . . .	0	6	12
Rutaceae . . .	0	10	6
Ampelideae . . .	1	13	16
Apocynaceae . . .	1	9	11
Gesneriaceae . . .	2	7	8
Tiliaceae . . .	2	8	13
Oleaceae . . .	3	13	10
Celastraceae . . .	4	34	23
Acanthaceae . . .	7	50	71

\* "K" (Kaffrarian Region). "N" (Natal, under 4000 ft.). E.M.R. (Eastern Mountain Region).

All the principal genera occurring in the Eastern Mountain Region are also well represented in the South-Eastern Region with the excep-

\* See Fig. 4.

tion of *Selago*, *Eragrostis*, *Schizoglossum*, *Euryops*, and *Zaluzianskya*, which are more numerous in the former region.

The large number of Cycadaceae in the South-Eastern Region should be specially noted, as no member of the Order has yet been recorded from the Eastern Mountain Region, and it is more than probable that they are totally absent from this region.

There are in the Eastern Mountain Region 812 species (or 52·31 per cent.) which also occur in the "Kaffrarian" flora, though of this number 317 species (or 20·4 per cent.) are common to the Kalahari Region, the Eastern Mountain Region, and the "Kaffrarian" Region.

#### VIII. SUMMARY.

The Eastern Mountain Region is a large plateau lying between the 28th and 30th degree of latitude and the 27th and 30th degree of longitude. It includes the whole of Basutoland with a portion of the Orange Free State, the Cape Province, East Griqualand, and Natal. On the confines of its boundaries it has an elevation of about 5000 ft., rising to 10,000 ft. and over on the Drakensbergen. The area is built up of Stormberg beds which lie on the Karroo beds. The rainfall averages about 29·39 inches per annum, most of which falls during the six summer months. The average maximum temperature is about 82° F., and the average minimum temperature about 33° F. In the greater amount of rainfall and lesser extremes of temperature the Eastern Mountain Region shows considerable differences from the Kalahari Region. The Eastern Mountain Region must be regarded as a grass steppe, and in this respect differs somewhat from the Kalahari and South-Eastern Regions, where the Grasses do not form such a predominant portion of the flora. The paucity of species of *Capparideae*, *Ampelidaceae*, *Asclepiadaceae*, *Convolvulaceae*, etc., separates it from the Kalahari Region, and the few species of *Acanthaceae*, *Celastraceae*, *Oleaceae*, *Rutaceae*, etc., which occur within its limits distinguish it from the South-Eastern Region. Among the genera the number of species of *Erica*, *Zaluzianskya*, *Wahlenbergia*, *Eulophia*, *Disa*, etc., which occur in the Eastern Mountain Region sharply separate it from the Kalahari Region, while the number of species of *Selago*, *Eragrostis*, *Schizoglossum*, *Euryops*, and *Zaluzianskya* distinguish it from the South-Eastern Region. Speaking generally the Eastern Mountain Region has an affinity with the South-Eastern Region, but is totally distinct from the Kalahari Region.

IX. LIST OF SPECIES OCCURRING IN THE EASTERN MOUNTAIN REGION, WITH DESCRIPTIONS OF NEW SPECIES.

DICOTYLEDONS.

RANUNCULACEAE.

CLEMATIS, *Linn.*

**C. brachiata**, Thunb.

Mountain Slopes. A creeping or climbing plant, 3-9 ft. high, flowers white and sweet scented. Summer. *A. Dieterlen*, 90! climber on trees in ravine, *Phillips*, 727! slopes of Lefi's Kloof, a climber, flowers white, *Phillips*, 813!

DISTRIBUTION: Cape. Swellendam. Uitenhage. Albany. Mur-raysburg. Somerset East. Komgha. East Griqualand. Natal. Transvaal (Rustenberg).

SESUTO: *Morarana oa mafelo*. The creeper for the churning sticks. The woody part of the plant, being strong and supple, is used for making churning sticks.

THALICTRUM, *Linn.*

1. **T. minus**, *Linn.*

Dongas and mountain slopes. Flowers green. Summer. *A. Dieterlen*, 380! Caledon River, *Zehyer*, 41! Doodman's Krans Mountain, 8700 ft., March, *Galpin*, 6568!

DISTRIBUTION: Queenstown. Aliwal North. Griqualand West (near Kimberley).

SESUTO: *Lefōkōtsane*. The small feeble one. *Tlōrō ea ngvale*. The hat of the "ngvale." A "ngvale" is a girl of the initiation school. The plant is used as a vegetable in the young state.

2. **T. rhynchocarpum**, D. & R.

De Beer's Pass, Drakensbergen, 5-6000 ft., *Wood*, 5971!

DISTRIBUTION: Komgha. East Griqualand. Transvaal (Pilgrim's Rest).

ANEMONE, *Linn.*

**A. Fanninii**, Harv.

Eland's River Valley, near the Mont-aux-Sources, 6000 ft., *Flanagan*, 2126!

DISTRIBUTION: Natal.

## RANUNCULUS, Linn.

**R. pinnatus**, Poir.

Damp spots on veld and mountain slopes. Herb, 5-18 in. high, flowers bright yellow. Summer-Autumn. *A. Dieterlen*, 141!

DISTRIBUTION: Cape. George. Uitenhage. Beaufort West. Komgha. Tembuland. Natal.

SESUTO: *Hlapi*. Fish.

**R. Meyeri**, Harv.

Banks of water courses. Herb, 1-5 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 599! swampy ground at the base of Doodman's Krans Mountain, 8500 ft., March, *Galpin*, 6566! swampy ground, near Buffalo River Waterfall, 8150 ft., March, *Galpin*, 6565! stream on Leribe plateau, common, flowers yellow, *Phillips*, 786! Natal, edge of swamp, Upper Tugela, 5-6000 ft., *Wood*.

DISTRIBUTION: Somerset East. King William's Town. Natal. Transvaal (Dordrecht, Standerton, Pretoria).

SESUTO: *Bolila ba linku ba metsi*. The water-sorrel of the sheep. Said to be liked by sheep and goats.

**R. Baurii**, MacOw.

Herb, 10-20 in. high. Slopes of high mountain, Matchachaneng, Bôtha-Bôtha. *A. Dieterlen*, 883! without precise locality, *Cooper*!

DISTRIBUTION: Tembuland. Natal.

SESUTO: *Qoyoana*. The small "qobo," so called on account of the leaves having the shape of those of *Gunnera perpensa* (Qobo).

In Madame Dieterlen's specimens there are fruits only, and the leaves are much larger than in the type.

**R. Cooperi**, Oliv.

Mont-aux-Sources, 9300 ft., October, *Mann in Herb. Marloth*; 2880! 7-9500 ft., January, *Flanagan*, 2124! 2125! Van Reenen, 5-6000 ft., December, *Wood*, 4537! Oliver's Hoek, 5-6000 ft., *Wood*; Ben McDhui, 9200-9600 ft., March, *Galpin*, 6567! *A. Bolus in Herb. Guthrie*, 4770!

DISTRIBUTION: Transvaal (Oliphant's River, 5400 ft., Carolina, 5600 ft.).

**R. Drouetii**, Godr.

River bed at Hlotse. Herb, 10-30 in. high, flowers white, October, *A. Dieterlen*, 808!

DISTRIBUTION: Cape. Transvaal (near Ermelo).

SESUTO: *Hlapi ea noka*. The fish of the river.



**R. sp.** (probably *R. plebeius*, R. Br.).

Leribe, *A. Dieterlen*, 899!

SESUTO: *Hlapi ea lōti*. The fish of the high mountain.

This is a very fragmentary specimen.

**R. sp.**

Swampy ground near Buffalo River Waterfall, 8150 ft., March, *Galpin*, 6565!

A slender creeping plant, rooting at the nodes. Leaves about 2 mm. long and 4 mm. broad, cordate and faintly 5-lobed.

## MENISPERMACEAE.

### STEPHANIA, *Lour.*

**S. hermadiaefolia**, Walp.

Mountain slopes. A climber, flowers cream. Spring-Summer. *A. Dieterlen*, 506!

DISTRIBUTION: Pondoland. East Griqualand. Natal. Swaziland.

SESUTO: *Lesibo*. Derived from the verb "ho siba"—to discover.

This plant is much used by the witch-doctors in working the divining bones when wishing to discover anything lost, or some secret matter.

## PAPAVERACEAE.

### PAPAVER, *Linn.*

**P. aculeatum**, Thunb.

Veld, and as a weed in cultivated ground. Herb, 6-35 in. high, flowers reddish-yellow. Spring-Summer. *A. Dieterlen*, 347!; mountain slopes above the Mission Station, flowers brick-red, *Phillips*, 511!; Mont-aux-Sources, 8000 ft., April, *Dyke in Herb. Marloth*, 5407! in *Herb. Musei Austro-Afric.* 5521!

DISTRIBUTION: Uitenhage. Somerset East. Murraysburg. Komgha. Natal. Orange Free State (Sand Drift).

SESUTO: *Sekhloho*. He who causes anger. Name given on account of the thorny nature of the plant.

### ARGEMONE, *Linn.*

**A. mexicana**, Linn.

Mountain slopes, road-sides, and near villages. Herbaceous plant 10-35 in. high, flowers pale yellow. Spring-Summer. *A. Dieterlen*, 350!

DISTRIBUTION : A weed which has become naturalised in South Africa.

SESUTO : *Ntšvantšane*. Derived from the verb "ho tsvantša"—to describe. *Sehlohlo se seholo*. The big one who caused anger. Name given on account of the thorny nature of the plant.

#### CORYDALIS, DC.

##### **C. pruinosa**, E. Mey.

Banks of Caledon River, Mettolloanany, Leribe District. A herb, 20–32 in. high, flowers light pink. Summer. *A. Dieterlen*, 873!; Tsitsa Footpath, Drakensbergen, 6900 ft., March, *Galpin*, 6569.

DISTRIBUTION : Somerset East. Murraysburg. East Griqualand. Natal.

SESUTO : '*Musa pelo oa nōka*. The river comforter. Literally "The one who puts the heart (of the river) right." Used by doctors for preparing drugs for comforting people in sorrow, especially in cases of bereavement.

#### CRUCIFERAE.

##### MATTHIOLA, Br.

##### **M. torulosa**, DC.

Caledon River, *Zeyher*, 17! *Burke*, 203!

DISTRIBUTION : Graaff Reinet. Aliwal North.

##### NASTURTIIUM, Br.

##### **N. officinale**, R. Br.

In streams. Herb, 6–25 in. long, flowers white. Summer. *A. Dieterlen*, 746.

DISTRIBUTION : Common throughout South Africa.

SESUTO : *Mo-hata-metsi*. The one who tramples on the water. Name given in reference to the floating nature of the plant. Edible.

##### **N. fluviatile**, E. Mey.; var. *caledonicum*, Sond.

Veld and mountain slopes. Herb, 18–38 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 823!; Caledon River, *Burke & Zeyher*, 227

DISTRIBUTION : Transvaal (Pretoria).

SESUTO : *Liababe*. They are bitter. Used as a vegetable.

##### var. **brevistylum**, Sond

Veld and mountain slopes. Herb, 5–22 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 98b!

DISTRIBUTION : Murraysburg.

SESUTO : *Papasane*. Meaning unknown. Used as a vegetable.

var.

Mountain slopes and veld, flowers yellow. *A. Dieterlen*, 98!

### ARABIS, *Linn.*

#### **A. perfoliata**, Lamk.

Damp spots. 1–3 ft. high, flowers reddish-mauve. Spring–Summer.

*A. Dieterlen*, 613!; Bester's Vlei, near Witzie's Hoek, 5400 ft. *Bolus*, 8119!

DISTRIBUTION : Somerset East. Molteno. Natal.

SESUTO : *Lefisoana*. Small pot. Used as a vegetable.

### SISYMBRIUM, *Linn.*

#### **S. capense**, Thunb.

Foot of Mont-aux-Sources, 6800 ft., January, *Flanagan*, 2084!

DISTRIBUTION : Uitenhage. Somerset East. Alice. Komgha.

var. **montanum**, Sond.

Veld, damp spots. Herb, 12–30 in. high, flowers yellow. Summer.

*A. Dieterlen*, 541!; Caledon River, *Burke & Zeyher*!

DISTRIBUTION : Orange River.

SESUTO : *Hlaku ea Khomo*. Ox leg. *Sentlokvana se seholo*. The big “Sentlokvana” (meaning unknown). The young parts of the plant are used as a vegetable.

#### **S. lyratum**, Burm.

Mountain slopes. Herb, 8–25 in. high, flowers yellow. January–April. *A. Dieterlen*, 836!

DISTRIBUTION : Malmesbury. Swellendam. George. Knysna. Albany. Beaufort West.

SESUTO : *Sentlokvana se seholo*. See *S. capense*, Thunb. var.

#### **S. Turezaniowii**, Sond.

Veld and mountain slopes. Herb, 6–15 in. high, flowers yellow. Spring–Autumn. *A. Dieterlen*, 183!; mountain slopes south of Leribe plateau, *Phillips*, 911!; Qoqolosi Peak, *Phillips*, 978!; Caledon River, *Zeyher*.

DISTRIBUTION : Transvaal (Volksrust).

SESUTO : *Sentlokvana*. Meaning unknown. Used as a vegetable.

## HELIOPHILA, Linn.

**H. suavissima**, Burch.

Leribe plateau, January, flowers purple or pink. *A. Dieterlen*, 939! partly; grassy spots on slopes of Mont-aux-Sources, c. 8800 ft., January, *Thode*, 1!; near Buffalo River Waterfall, 8220 ft., March. *Galpin*, 6570; Satsanna Berg, 9400 ft., *Galpin*, 6571.

DISTRIBUTION: Port Elizabeth, Graaff Reinet.

**H. rigidiuscula**, Sond.

Mont-aux-Sources, 9950 ft., *Flanagan*!; Bester's Vlei, near Witzie's Hoek, 6200 ft., *Bolus*, 8121! 6500 ft., December, *Flanagan*, 1846!; Ben McDhui, 9800 ft., March, *Galpin*, 6572.

DISTRIBUTION: Queenstown. Komgha. Transkei. Pondoland. East Griqualand. Natal. Transvaal (Barberton, Botsàbelo). Swaziland.

**H. sulcata**, Conrath.

Mountain slopes, 8–25 in. high, flowers white. Summer–Autumn. *A. Dieterlen*, 284!; common on mountain slopes and plateau, flowers white, *Phillips*, 675! 806! 883! 927! 971!; Bester's Vlei, near Witzie's Hoek, 6500 ft., December, *Flanagan*, 1856! 5400 ft., *Bolus*, 8120!; Ladybrand, November, *Rogers*, 714!

DISTRIBUTION: Namaqualand Minor. Molteno. Aliwal North. Transvaal (Johannesburg).

SESUTO: '*Musa pelo oa mangope*. The comforter of the dongas. *Tloko filvane e kholo*. The big "tloko-filvane" (foam or froth). *Semanelvana*. Derived from the verb "ho namela"—to listen to. Used by the witch doctors for locating pain by means of sound (auscultation), especially in chest complaints. It is supposed to concentrate the pain on one side and thus enable it to be cured.

**H. basutica**, Phillips, sp. nov. (Plate V, fig. i). *Suffrutex* humilis, 5–9 cm. altus. *Ramuli* scabridi. *Folia* 9–4 cm. longa, 5–1.5 mm. lata, linearia, apice acuta vel obtusa, integra. *Pedunculus* 2–7 cm. longus, nudus vel foliiferus. *Pedicellus* circiter 1 cm. longus. *Sepala* 5.5–6.5 mm. longa, 1.5–2 mm. lata, oblonga, glabra. *Petala* 1 cm. longa, 4.5–6.5 mm. lata, obovata, apice obtusa. *Stamina* omnia aequalia; filamenta 4 mm. longa, linearia; antherae 2.5 mm. longae, oblongae. *Ovarium* sessile, 4 mm. longum, glabrum; stylus 1.5 mm. longus; stigma globosum. *Fructus* ad 4.7–5.5 cm. longus, 3–3.5 mm. latus, planus; margines rectae vel undulatae. *Semina* 2–2.25 mm. longa, 1.5–2 mm. lata, discoidea, fere orbiculata, semi-translucida.

A dwarf plant 5–9 cm. high, with thick woody underground stems

from which short branches arise. *Branches* minutely scabrid. *Leaves* .9-4 cm. long, .5-1.5 mm. broad, linear, acute or subacute, glabrous. *Peduncles* 2-7 cm. long, terete, glabrous, 5-12-flowered. *Pedicels* .8-1.2 cm. long, elongating in the fruit, sometimes minutely glandular, otherwise glabrous. *Buds* .9-1 cm. long, 2.5 mm. broad, ellipsoid, the anterior and posterior sepals slightly projecting. *Lateral sepals* 5.5 mm. long, 1.5 mm. broad, oblong-linear, concave, rounded and saccate at the apex, 3-nerved, glabrous; anterior and posterior sepals 6.5 mm. long, 2 mm. broad, oblong-linear, concave, rounded and with a blunt spur .5 mm. long at the apex, 3-nerved, glabrous. *Petals* 1 cm. long, 4.5-6.5 mm. broad, obovate, shortly acuminate, obtuse, narrowed at the base. *Stamens* of equal length; filaments 4 mm. long, linear below, terete above, glabrous; anthers 2.5 mm. long, linear, shortly and bluntly sagittate at the base. *Ovary* 4 mm. long, .75 mm. broad, terete, glabrous; style 1.5 mm. long, terete; stigma capitate. *Fruit* 4.7-5.5 cm. long, 3-3.5 mm. broad, flat; valves with straight or undulating margins, 1-nerved, glabrous. *Seeds* 2-2.25 mm. long, 1.5-2 mm. broad, compressed, orbicular, glabrous; embryo horse-shoe shaped.

Qoqolosi Peak. January-February, flowers purple or pink, *A. Dieterlen*, 939 partly; *Phillips*, 975.

Near *H. suavissima*, Burch., from which it differs in the dwarf woody habit, and the seeds being without a narrow membranous margin.

**H. sp.**

Ben McDhui, 9800 ft., March, *Galpin*, 6573.

## BRASSICA, *Linn.*

**B. pachypoda**, Thellung, var.

Veld and mountain slopes. Herb, 6-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 165!

DISTRIBUTION: An imported weed.

SESUTO: *Sepatla-palla*. Derived from the verb "ho phatlalla"—to be flat. *Sepaile*. Meaning unknown. The leaves of this plant lie flat on the ground. Used as a vegetable.

## LEPIDIUM, *Linn.*

**L. myriocarpum**, Sond.

Streams. Herb, 20-30 in. high, flowers dark-mauve. Summer.

*A. Dieterlen*, 542!; Caledon River, *Zeyher*, 24!

DISTRIBUTION: Glenfilling (Lower Albany).



SESUTO: *Lerōthō*. Dimness. Name probably given to the dark colour of the flower. Used as a vegetable.

**L. capense**, Thunb.

Veld, mountain slopes and round villages. Herb, 4–12 in. high, flowers brownish-red. Spring–Autumn, *Dieterlen*, 137b!

DISTRIBUTION: Cape. Swellendam. Uitenhage. Murraysburg. Komgha. Natal.

SESUTO: *Sebitsa*. It calls. Used as a vegetable.

**var.**

Ben McDhui, 9800 ft., *Galpin*, 6574; Doodman's Krans Mountain, 8650 ft., *Galpin*, 6574a.

**L. Schinzii**, Thellung.

Veld and round kraals. Herb, 4–18 in. high, flowers white. Spring–Summer, *A. Dieterlen*, 137a!

DISTRIBUTION: An imported weed.

SESUTO: See *L. capense*, Thunb.

## CAPPARIDEAE.

### CLEOME, *Linn.*

**C. monophylla**, Linn.

Sandy places on mountain slopes. 5–20 in. high, flowers mauve. January–February. *A. Dieterlen*, 787!

DISTRIBUTION: S.W. Africa. Herbert. Komgha. Transkei. Pondoland. Natal. Transvaal (Pretoria, Waterberg, Magaliesberg, Barberton). Swaziland. Delagoa Bay.

SESUTO: '*Musa pelo monyenyane*. The small comforter.

## RESEDACEAE.

### OLIGOMERIS, *Cambeso*.

**O. dregeana**, Presl.

Veld and mountain slopes. Small plant, 5–18 in. high, flowers white. Summer. *A. Dieterlen*, 286!; Van Reenen, 5500 .., February, *Wood*.

DISTRIBUTION: Cradock. Graaff Reinet. Somerset East. Aliwal North. Tembuland. Orange Free State (near Bethulie, Bankfontein).

SESUTO: *Pheta*. Repeat. Used in medicine when working the

divining bones. A witch-doctor is supposed by this means to be able to avenge a man who has been bewitched by a distant enemy who has sent lightning to him or his cattle.

## BIXINEAE.

### KIGGELARIA, *Linn.*

#### **K. africana**, *Linn.*

Mountain slopes. A tree, flowers cream. Spring. *A. Dieterlen*, 180 !; Ravine on western slopes of Leribe plateau, tree 20 ft. high, *Phillips*, 743 ! 755 !

DISTRIBUTION : Cape. Tulbagh. East Griqualand. Natal. Transvaal (Sabie Hoek, Devil's Kantoor).

SESUTO : *Lekhatsi*. Meaning unknown. Wood used for lathes. Used by the witch doctors in compounding a medicine to protect villages.

## PITTOSPOREAE.

### PITTOSPORUM, *Banks.*

#### **P. viridiflorum**, *Sims.*

Mountain slopes and ravines. Tree, 8-10 ft. high, flowers yellowish. Spring. *A. Dieterlen*, 389 !

DISTRIBUTION : George. Port Elizabeth. Graaff Reinet. Albany. King William's Town. Komgha. Tembuland. Natal. Transvaal (Magaliesberg, Barberton).

SESUTO : *Mosetlele*. Meaning unknown. *Mohattolle*. He who relieves. *Motsōsa-nku*. The sheep helper. *Phukhu e nyenyane*. The small "Phukhu." This tree is much used by the native doctors. It is also used when working the divining bones to prevent a sick person being harmed by other people.

## POLYGALACEAE.

### POLYGALA, *Linn.*

#### **P. virgata**, *Thunb. var.*

Ravines and mountain slopes. 3-5 ft. high, flowers carmine. Autumn. *A. Dieterlen*, 577 !; Mont-aux-Sources, c. 9300 ft. October, *Mann in Herb. Marloth*, 2882 !

DISTRIBUTION : Cape. Uitenhage. Port Elizabeth. Transkei. East

Griqualand. Natal. Transvaal (Barberton, Pilgrim's Rest, Lydenburg). Swaziland.

SESUTO: *Hlokoa lelele*. The large piece of grass. *Ntsebele ea moru*. Tell me of the woods. *Hlokoa* is the diminutive form of "Lefhloko ana," meaning "a piece of grass." Used as a love philtre.

This specimen does not fit any of the varieties into which Harvey divides the species. It is an exact match with a plant from Natal collected by Gueinzus, and more nearly so with the Uitenhage specimens. The plants from the other localities cited differ in their broader leaves; they all, however, form a distinct group in the species.

**P. hispida**, Burch.

Mountain slopes. 4-10 in. high, flowers pinkish-mauve. December. Malavaneng, Leribe district. *A. Dieterlen*, 868!; near Buffalo River Waterfall, 8220 ft., March, *Galpin*, 6579; near "Cave" at foot of Mont-aux-Sources, 6800 ft., *Flanagan*, 2082!; Giant's Castle, Drakensbergen, 6000 ft., November, *A. Bolus in Herb. Guthrie*!

DISTRIBUTION: George. Uitenhage. Albany. Dohne.

SESUTO: *Bolao ba nōka*. The philtre of the river (or love philtre). Dr. Bolus notes that Flanagan's plant is "probably the same form as *P. erubescens*, E. Mey., collected by Drège on the Wittebergen."

**P. Ohlendorffiana**, E. & Z.

Mountain slopes and banks of streams. 5-12 in. high, flowers carmine pink. Summer. *A. Dieterlen*, 624!; ravine on west slopes of Leribe plateau, 4-6 in. high, flowers red, *Phillips*, 766!; Bester's Vlei, near Harrismith, 6200 ft., December, *Bolus*, 8122!

DISTRIBUTION: Somerset East. King William's Town. Stutterheim. East Griqualand. Natal. Swaziland.

SESUTO: *Mahlakahlaka*. Many leaves. Use unknown.

**P. amatymbica**, E. & Z.

Mountain slopes,  $1\frac{1}{2}$ -6 in. high, flowers violet. Summer. *A. Dieterlen*, 148!

DISTRIBUTION: Queenstown. East Griqualand. Tembuland. Transvaal (Pretoria, Pietersburg, Standerton, Barberton, Rustenburg).

SESUTO: *Mohlolhelle* or *Molelabeho o monyenyane*. Stimulant. Used as a medicine for cattle.

**P. Galpini**, Hook.

Sides of Giant's Castle, *Sim*.

DISTRIBUTION: Transvaal (Vryheid). Swaziland.

**P. gymnoclada**, MacOw.

Veld and mountain slopes. 10-32 in. high, flowers pink. Summer-Autumn. *A. Dieterlen*, 249!; growing among grass, Lefi's Kloof, N.E. slope of Leribe plateau, *Phillips*, 815!; Near Buffalo River Waterfall, 8220 ft., March, *Galpin*, 6580.

DISTRIBUTION: Transkei. East Griqualand. Swaziland.

SESUTO: *Mohlōko*. Meaning unknown. *Hlokoa la tsela*. The piece of grass of the road. *Lehlokoana la Balimo*. The piece of grass of the ancestors. *Mohlabehe o moholo*. The strong stimulant. *Ntsebele*. Tell me. Used as a love philtre and also when working the divining bones. Most species of *Polygala* are used in this way.

**P. rarifolia**, DC.

Veld and mountain slopes, 5-18 in. high, flowers violet. *A. Dieterlen*, 267! 716!; slopes of ravine between the Mission Station and Jonathan's village, not uncommon, flowers blue, *Phillips*, 555! mountain slopes above Khaniane, south slopes of Leribe plateau, flowers red, *Phillips*, 857! Qoqolosi Peak, *Phillips*, 987!

DISTRIBUTION: Uitenhage. Stockenström. Cradock. Murraysburg. Komgha. Transkei. Tembuland. Pondoland. East Griqualand. Natal. Swaziland.

SESUTO: *Bolao bo boholo*. The big philtre. *Lesira*. The veil. *Setea-tea*. The deciever. Used as love philtres and as a charm to rid oneself of a tormentor.

**P. sp.**

Ben McDhui, 9260 ft., March, *Galpin*, 6578; Doodman's Krans Mtn., 8500 ft., *Galpin*, 8578a.

MURALTIA, Neck.

**M. divaricata**, E. & Z.

Mountain slopes and plateau. 2-4 ft. high, flowers white. Summer. *A. Dieterlen*, 296!

DISTRIBUTION: Van Rhynsdorp. Clanwilliam. Tulbagh.

SESUTO: 'Ma Motaung. The mother of "Motaung." Used for firewood.

**M. dumosa**, DC.

Basutoland, without precise locality, *Cooper*, 707!

DISTRIBUTION: Van Rhynsdorp. Tulbagh. Cape. Laingsburg (Seven Weeks Poort). Albert.

**M. alticola**, Schltr.

Bester's Vlei, near Witzie's Hoek, 5800-6700 ft., December, *Flanagan*, 1842! *Bolus*, 8123!

DISTRIBUTION: Tembuland.

**M. Flanaganii**, Bolus (= *M. ecornuta*, N. E. Br.).

Summit Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2020!, October, *A. Bolus*! *Mann in Herb. Marloth*, 2871! 2881!; Natal, Van Reenen, 6-7000 ft., *Wood*, 5699!

DISTRIBUTION: Endemic.

**M. saxicola**, Chodat.

Mont-aux-Sources, 6000 ft. October, *A. Bolus in Herb. Guthrie*, 4775!; Bushman's River Valley, 6-8000 ft., October, *Wylie in Herb. Wood*, 10632!; Catkin Peak, Drakensbergen, 8500-9000 ft., *West in Herb. Musei Austro-Afric.*, 4555!; Van Reenen, 6900 ft., Schltr., 6934!

DISTRIBUTION: East Griqualand.

This is a plant which I described as *M. Westi* (Ann. S. Afr. Mus. ix, iii, 13), but the above name has priority.

**M. sp.**

Bushman's Caves, Drakensbergen, 7-8000 ft., *Evans*, 666.

## CARYOPHYLLACEAE.

## DIANTHUS, Linn.

**D. scaber**, Thunb.

Mountain slopes and plateau, 7-20 in. high, flowers pale pink. Summer. *A. Dieterlen*, 184!; slopes of ravine between the Mission Station and Jonathan's Village, *Phillips*, 556!, south slopes of Leribe plateau, above Khaniane, flowers pale pink, *Phillips*, 874!, Qoqolosi Peak, flowers pink, *Phillips*, 976!; Ben McDhui and Doodman's Krans Mtn., 9900 ft., March, *Galpin*, 6581!

DISTRIBUTION: S.W. Africa. Clanwilliam. Worcester. Tulbagh. George. Uitenhage. Graaff Reinet. Beaufort West. Aliwal North. Natal. Orange Free State. Transvaal (Pretoria, Johannesburg). Bechuanaland (Kuruman).

SESUTO: *Tlōkōfīloane*. Big froth. *Mogo o*. Derived from the verb "ho qolla"—to choose. Used as a medicine for chest pains. It is also supposed to relieve one's fears and emotions.



**D. crenatus**, Thunb.

Bester's Vlei, near Witzie's Hoek, 5500 ft., *Flanagan*, 1861

DISTRIBUTION: S.W. Africa. Albany. Komgha. Tembuland. East Griqualand. Natal.

3. **D. pectinatus**, E. Mey.

Bester's Vlei, near Harrismith, 5500 ft., December, *Bolus*, 8124

DISTRIBUTION: S.W. Africa. Tulbagh. Worcester. Transvaal (Pretoria, Johannesburg).

SILENE, *Linn.*

**S. capensis**, Ott.

Mountain slopes and sides of dongas. Herb, 8–25 in. high, flowers white. Summer. *A. Dieterlen*, 28!; without precise locality, *Cooper*!; ravine on west slopes of Leribe plateau, flowers white, occasional, *Phillips*, 606!

DISTRIBUTION: S.W. Africa. Clanwilliam. Cape. Caledon. Alexandria. Murraysburg. Beaufort West. Komgha. Natal. Orange Free State (Vryburg). Transvaal (Rustenburg).

SESUTO: *Molokōlōko*. In succession. *Letomokoana*. The small "Letomōkō." *Likomana* and *Lithotana*. Small boxes or baskets. *Shetla la moroke*. The soft bone of "Moroke" (a proper name). *Kvag̃la*. Meaning unknown. Used as a medicine in many diseases, especially in cases of fever and delirium.

**S. Burchellii**, Ott.

Mountain slopes, 5–20 in. high, flowers pale mauve. Spring. *A. Dieterlen*, 362! 610!; Ben McDhui, 9250–9500 ft., March, *Galpin*, 6583.

DISTRIBUTION: Malmesbury. Cape. Caledon. Uitenhage. Albany. Graaff Reinet. Molteno. Transkei. East Griqualand. Natal. Transvaal (Rustenburg, Mooifontein, Johannesburg).

SESUTO: *Lepatla*. Derived from the verb "hobatla"—to search. *Lithotana*. Small baskets. *Kopane*. Derived from the verb "ho kopa"—to surround. Used in the compounding of various medicines.

CERASTIUM, *Linn.*

**C. dregeanum**, Fenzl.

Mountain slopes, flowers white, January. Malavaneng. *A. Dieterlen*, 935!; Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2076!; Ben McDhui, 9900 ft., March, *Galpin*, 6585!; Doodman's Krans Mtn., 8500–9650 ft., March, *Galpin*, 6585a!

DISTRIBUTION: Cape. Albany. Tembuland. East Griqualand. Natal.

SESUTO: *Qōqōbala ea lōti*. The "Qōqōbala" of the high mountain. Use unknown. See *C. Capense*, Sond.

**C. capense**, Sond.

Damp spots on mountain slopes and plateau. Herb, 3-15 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 265a!

DISTRIBUTION: Clanwilliam. Tulbagh. Cape. Caledon. Graaff Reinet. Somerset East. Murraysburg. Komgha. Transvaal (Ermelo).

SESUTO: *Qōqōbala*. Derived from the verb "ho qōqōbala"—to have superficial roots. *Moloō oa nku*. The bleating of the sheep. Eaten when young.

STELLARIA, *Linn.*

**S. media**, Vill.

Damp and shady spots on mountain slopes. Herb, 3-15 in. high. April. Morija. *A. Dieterlen*, 265b!

DISTRIBUTION: Cape. Kaffirland. Natal.

SESUTO: See *Qōqōbala*. See *Cerastium capense*, Sond.

SPERGULA, *Linn.*

**S. arvensis**, Linn.

Shady places on mountain slopes. 6-18 in. high, flowers white. August. *A. Dieterlen*, 825!

DISTRIBUTION: Tulbagh. Cape. Stellenbosch. Natal.

SESUTO: *Bolepo ba seokho sa merung*. Web of the "spider of the woods." *Qōqōbala*. The "Qōqōbala" of the lands. Use unknown.

PORTULACEAE.

PORTULACA, *Linn.*

**P. oleracea**, Linn.

Veld and mountain slopes. 2-18 in. high, flowers yellow. Summer. *A. Dieterlen*, 303!

DISTRIBUTION: S.W. Africa. Albany. Natal. Orange Free State (Bloemfontein).

SESUTO: *Selèlè*. Slippery. The natives sprinkle themselves with a preparation of this plant as a charm against illness and lightning. Eaten as a vegetable.

ANACAMPSEROS, *Linn.*

*A. arachnoides*, Sims.

Mountain slopes. 2-8 in. high, flowers pink. Summer. *A. Dieterlen*, 625!

DISTRIBUTION: Uitenhage. Montague. Albany. Prince Albert.

SESUTO: *Serelele*. Derived from the verb "ho rella"—to be slippery. Used in many medicines by the native doctors; said to be an emetic. A medicine for a sick orphan child.

TALINUM, *Adans.*

*T. caffrum*, E. & Z.

Mountain slopes. 6-20 in. high, flowers yellow. Summer-Autumn. Thaba Phatsoa, Leribe District. *A. Dieterlen*, 701!

DISTRIBUTION: S.W. Africa. Port Elizabeth. Graaff Reinet. Queenstown. Komgha. Tembuland. Natal. Transvaal (Pietersburg, Rustenberg). Bechuanaland (Kuruman). Bulawayo.

SESUTO: *Khutsana*. Orphan. This plant is employed by the native doctors, but no information can be got from them as to its use.

HYPERICINEAE.

HYPERICUM, *Linn.*

*H. aethiopicum*, Linn.

Mountain slopes, 6-14 in. high, flowers bright yellow. Summer. *A. Dieterlen*, 358!; west slopes of Leribe plateau, frequent, flowers yellow, *Phillips*, 654! N.E. slopes of Leribe plateau, flowers yellow, frequent, *Phillips*, 851!, south slopes of Leribe plateau, flowers yellow, *Phillips*, 921!; Basutoland, without precise locality, *Cooper*!

DISTRIBUTION: Riversdale. George. Knysna. Uitenhage. Graaff Reinet. King William's Town. Komgha. Natal. Transvaal (Pretoria). Swaziland.

SESUTO: *Leilane*. Derived from the verb "hoila"—to avoid. *Leilane la Bale*. The "Leilane" of the "Bale" ("Bale" is the plural of "Ngoale"—a girl attending the heathen school of initiation). *Bohohoana*. Little bread. *Tabane*. Small matter. This plant is largely used by the women for young girls who have reached the age of puberty.

*H. Lalandii*, Chois.

Damp spots on mountain slopes, 2-12 in high, flowers yellow. Summer. *A. Dieterlen*, 678!; damp spots near stream on plateau,

flowers yellow, *Phillips*, 792 !, south slopes of Leribe plateau, flowers yellow, *Phillips*, 905 ! 914 !

DISTRIBUTION : George. Uitenhage. Aliwal North. Komgha. East Griqualand. Natal. Transvaal (Lydenburg, Pietersburg). Swaziland. Bulawayo.

SESUTO : *Bohlokanyane*. Small pain. Used in medicine.

## MALVACEAE.

### MALVA, *Linn.*

#### *M. parviflora*, *Linn.*

Veld, near villages, 3–12 in. high, flowers pale mauve. Summer–Autumn. *A. Dieterlen*, 110a !

DISTRIBUTION : An introduced weed.

SESUTO : *Mosalasupe*. He who remains on the ruins. *Qena*. Give up a trip. *Tika-motse*. Surround the village. *Thiba-pitsa*. Stop the pot. Used for making a kind of cement for mending broken pots. Also used as a lotion for bathing bruised limbs.

This plant is an exact match with a specimen in our herbarium, collected near Cape Town, and labelled in Harvey's handwriting *M. parviflora*, *Linn.*

#### *M. verticillata*, *Linn.*

Mountain slopes and veld near villages, 8–35 in. high, flowers pale mauve. Summer–Autumn. *A. Dieterlen*, 110b !

DISTRIBUTION : An introduced weed.

SESUTO : See *M. parviflora*, *Linn.*

## ABUTILON, *Gaertn.*

#### *A. sonnerati* *Sweet.*

Mountain slopes, 8–22 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 453 !

DISTRIBUTION : Namaqualand Minor. Swellendam. Uitenhage. Graaff Reinet. Beaufort West. Komgha. East Griqualand. Natal. Orange Free State (Bloemfontein). Transvaal (Rustenburg). Bechuanaland.

SESUTO : *Lecheane*. Derived from the verb “hochea”—to grow plentifully in one place and yet widely spread. Used as a stimulant for bulls in the spring.

SPHAERALCEA, *St. Hil.*

**S. pannosa**, Bolus.

River banks and mountain slopes.  $1\frac{1}{2}$ –4 ft. high, flowers pinkish-mauve. Summer–Autumn. *A. Dieterlen*, 469!

DISTRIBUTION: East Griqualand. Natal. Hope Town.

SESUTO: *Lecheane le nōka*. The “Lecheane” of the river. See *Abutilon sonneratianum*, Sweet. Use unknown.

**S. prostrata**, Harv. var. *molle*.

Mountain side, near Buffalo River Waterfall, 7740 ft., Shrub 4 ft. high, flowers pink, March. *Galpin*, 6586!

DISTRIBUTION: Aliwal North.

**S. Julii**, Bkr. fil.

Banks of Eland’s River, near Witzie’s Hoek, c. 5700 ft., December. *Thode*, 2!; Caledon River, *Zeyher*, 217!

DISTRIBUTION: Aliwal North. Hope Town.

HIBISCUS, *Linn.*

**Hibiscus leiospermus**, Harv.

Veld and mountain slopes. 3–15 in. high. Summer. *A. Dieterlen*, 124!; Van Reenen, 5500 ft., December, *Wood*, 7467.

DISTRIBUTION: East Griqualand. Natal. Transvaal (near Irene, Belfast).

SESUTO: *Sefala-bohoho*. The crust scraper. Used in medicine for colic.

**H. malacospermus**, E. Mey.

Veld, road sides, and mountain slopes, 3–12 in. high, flowers carmine and cream. Summer. *A. Dieterlen*, 276!; Mafeteng, December, *Herman Bolus in Herb. Bolus*!; Bester’s Vlei, 5400 ft., December, *Bolus*, 8125!

DISTRIBUTION: Queenstown. Aliwal North. Tembuland. East Griqualand. Natal. Transvaal (Rustenburg, Lydenburg). Orange Free State (Bethalem).

SESUTO: *Sekutle*. Meaning unknown. *Seputle*. Derived from the verb “ho putla”—to cut in two. *Bohoyana*. Small bread. Used as a charm to prevent villages being bewitched by enemies or struck by lightning. Medicinally used as a cure for headache and other ailments.



**H. pusillus**, Thunb.

Thaba Unchu, *Zeyher*!

DISTRIBUTION: Port Elizabeth. Albany. Graaff Reinet. Griqualand West (Kimberley). Komgha. East Griqualand. Natal. Zululand. Transvaal (Pretoria, Rustenberg). Bechuanaland (Mafeking). Bulawayo.

**H. atromarginatus**, E. & Z.

Mountain slopes, 6-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 450!

DISTRIBUTION: Graaff Reinet. Queenstown. Aliwal North. Hope Town. Komgha. Natal. Orange Free State (Bloemfontein). Transvaal (Waterberg). Swaziland. Rhodesia (Bulawayo).

SESUTO: *Semameloa* *se sehola*. The big "Semameloa." A favourite plant with the witch-doctors. See also *Heliophila sulcata*, Conrath.

**H. Trionum**, Linn.

Veld and mountain slopes 3-22 in. high, flowers yellow with a dark centre, March, *A. Dieterlen*, 85! 632!; ravine, west slopes of Leribe plateau, corolla pale yellow with a dark throat, *Phillips*, 746!, south slopes of Leribe plateau, *Phillips*, 895!; Van Reenen, 5500 ft., December-May, *Wood*, 5705!

DISTRIBUTION: Cape. Alexandria. Murraysburg. Graaff Reinet. Beaufort West. Cradock. King William's Town. Komgha. Transkei. East Griqualand. Transvaal (Pietersburg, Rustenberg, Barberton). Bechuanaland. Swaziland.

SESUTO: *Lereletsane le leholo*. The big smooth one (*Dieterlen*, 85, which is var. *hispidus*). *Lereletsane*. The smooth one. (*Dieterlen*, 632, which is var. *ternatus*).

## STERCULIACEAE.

## HERMANNIA, Linn.

**H. candicans**, Ait.

Mountain slopes near rocks. 3-5 ft. high, flowers yellow. Autumn. *A. Dieterlen*, 555!

DISTRIBUTION: Clanwilliam. Stellenbosch. Swellendam. Riversdale. Humansdorp. Port Elizabeth. Albany. Uitenhage. Graaff Reinet. Worcester (Matjesfontein). Beaufort West. Prince Albert. King William's Town. Komgha. East Griqualand.

SESUTO: *Lecheane la thaba*. The "Lecheane" of the mountain.

The word "lecheane" is derived from the verb "ho cheana"—to be dispersed or in rags, though growing abundantly together. Use unknown.

**H. pallens**, E. & Z.

Mountain slopes. 10–20 in. high, flowers yellow. Spring. *A. Dieterlen*, 755!

DISTRIBUTION: S.W. Africa. Tulbagh. Caledon. Oudtshoorn. Uitenhage. Graaff Reinet. Aliwal North. Murraysburg. Beaufort West.

SESUTO: *Motoo oa thaba*. The bleating of the mountain. Use unknown.

**H. depressa**, N. E. Br.

Veld and mountain slopes. A creeping plant, 4–20 in. long. Flowers reddish-yellow. Spring–Summer. *A. Dieterlen*, 107!

DISTRIBUTION: S.W. Africa. Tembuland. Griqualand East. Natal. Transvaal (Johannesburg, Rustenberg, Zeerust, Barberton). Orange Free State (Bloemfontein). Rhodesia (Mazoe).

SESUTO: *Seletjane*. Meaning unknown. *Phate ea ngaka*. The bedding (or carpet) of the doctor. Used by the native doctors when working the divining bones. A native doctor seldom uses any medicine without consulting the divining bones, which are supposed to indicate both the illness and the medicine to be employed. A much renowned medicine for colic. Also used as a charm against witchcraft.

**H. Gerrardi**, Harv.

Hillside between Trent Kop and Antelope Park, Dist. Mclear, c. 5600 ft. March, flowers creamy white. *Galpin*, 6589!; Mount Fletcher, 5000 ft., July, *Sim*, 2529!

DISTRIBUTION: Natal.

**H. Woodii**, Schinz.

Grassy slopes on Klein Pot River, 4600 ft. March. Flowers pink. *Galpin*, 6588!

DISTRIBUTION: Natal. Transvaal (Pretoria, Magaliesberg).

MAHERNIA. *Linn.*

**M. coccocarpa**, E. & Z.

Veld and mountain slopes. 4–15 in. high, flowers dark violet. Spring–Summer. *A. Dieterlen*, 338!; mountain slope above the Mission Station, small shrub 3–6 in. high, flowers red, uncommon, *Phillips*,

529 !, Qoqolosi Peak, flowers pink, *Phillips*, 953 !; Bester's Vlei, near Harrismith, 5300 ft., December, *Bolus*, 8126 !; near Mafeteng, October, *Herman Bolus in Herb. Bolus*, 4381 !

DISTRIBUTION: S.W. Africa. Calvinia. Graaff Reinet. Molteno. Queenstown. Albert. Aliwal North. King William's Town. Natal. Griqualand West (Kimberley). Orange Free State (near Bethulie). Transvaal (Vaal River). Bechuanaland.

SESUTO: *Leilane Boloulo*. The loose soft one, who avoids or turns from. *Boulvana*. The small loose one. *Qena e nyenyane*. The small "qena." The verb "ho qena" means to dislike or avoid. *Sehlare sa mollo*. Medicine of fire. A preparation for use in burns is made from this plant.

*M. chrysantha*, Turez.

Mountain slopes. A creeper, 10-40 in long, flowers cream. Summer. *A. Dieterlen*, 43a ! 43b !; Lefi's Kloof, N.E. slopes of Leribe plateau, flowers white, rare, *Phillips*, 821 !; rocky hill near Harrismith, 5000 ft., February, *Wood*, 4723 !

DISTRIBUTION: Albany. Queenstown. Somerset East. Albert. King William's Town. Stockenström. Pondoland. Tembuland. Natal. Transvaal (Vlakfontein). Bechuanaland.

SESUTO: *Khoakhooa*. Derived from the verb "ho khoakhoathelo"—to adhere. Used as a cement for repairing broken clay pots. A medicine for heartburn and other complaints. This plant is highly esteemed and much used for flatulency in pregnant women.

*M. cordata*, E. Mey.

Veldt and mountain slopes. 10-22 in. high, flowers yellow. Summer. *A. Dieterlen*, 47 !; slopes of ravine, flowers yellow, December, *A. Dieterlen*, 949 !; Bester's Vlei, near Harrismith, 5500 ft., December, *Bolus*, 8127 ! *Flanagan*, 1884 !; Caledon River, *Zeyher* ! Thaba Unchu, *Burke & Zeyher* !

DISTRIBUTION: Transvaal (Irene, Heidelberg).

SESUTO: *Lecheane*, see *Hermannia candicans*, Ait. *Seletjane se seholo*, the big "seletjane." Used as a stimulant for bulls in the spring.

*M. oblongifolia*, Harv.

Between Thaba Unchu and Caledon River, *Burke & Zeyher* !

DISTRIBUTION: Aliwal North.

In examining and naming some plants collected in Basutoland by Madame Dieterlen I came across two sheets labelled *Mahernia chrysantha*,

Planch., and *M. cordata*, E. Mey., respectively, but when comparing the specimens with those in our herbarium and with the descriptions given in the 'Flora Capensis' I found that Harvey had sunk *M. cordata*, E. Mey., into *M. betonicaefolia*, E. & Z.\* Following the description of *M. chrysanth*a, Planch., Harvey adds the following note: "Larger and more woody than *M. betonicaefolia*, with longer leaves and flower-stalks, longer and narrower petals, and more acuminate and more woolly calyx-lobes, but in other respects so similar that we suspect it is merely a very luxuriant variety, and retain the species chiefly in deference to the opinion of other botanists." Among the specimens quoted by Harvey under the two species *M. chrysanth*a and *M. betonicaefolia*, we have in the South African Museum Collection the following: *Melhan*ia *chrysanth*a, E. Mey., collected by Drège; *Burke's* specimen No. 158 from Dornkop, Bechuanaland; *Ecklon and Zeyher's* No. 320 from Katriver and *Mahernia cordata*, E. Mey., collected by Drège at Stormberg. A detailed examination of these as well as other specimens at my disposal makes me agree with Harvey that *M. chrysanth*a, Planch., and *M. betonicaefolia* E. & Z., are co-specific, but I do not agree with him in sinking *M. cordata*, E. Mey., as a synonym of *M. betonicaefolia*, E. & Z., and I should prefer to separate them out as follows:

1. *M. chrysanth*a, Turez (*M. betonicaefolia*, E. & Z., *Hermannia geniculata*, E. & Z., *Melhan*ia *chrysanth*a, E. Mey.).

2. *M. cordata*, E. Mey.

The habit of the two species varies: in *M. chrysanth*a the flowers are always arranged along the length of the stem and arise from the axils of the leaves, while in *M. cordata* the flowers are grouped up in a panicle at the end of the stem. This difference in habit is always associated with other characters, as the table given below will show.

<i>M. chrysanth</i> a, Turez.	<i>M. cordata</i> , E. Mey.
Flowers large, over 1 cm. long.	Flowers smaller, under 1 cm. long.
Pedicels over 1 cm. long.	Pedicels usually less than 1 cm. long.
The calyx is villous within.	The calyx is glabrous within.
Lower half of the petals about 9-nerved.	Lower half of the petals always 3-nerved

Madame Dieterlen gives the colour of the corolla as yellow in *M. cordata* and cream in *M. chrysanth*a, and in most cases this seems

\* Szyszylowicz, 'Polypetalae Thalamiflorae, Rehmannianae' (1887), p. 143, follows the 'Flora Capensis.'

to hold good, but it is evidently not a constant character, as sometimes in *M. chrysantha* (Wood, 4723, *E. & Z.*, 320, 321) the corolla is said to be yellow.

*M. chrysantha* (Turez, in Bull. Soc. Nat. Mosc. xxxi (1858), i, 219). A prostrate plant. *Stem* and branches terete, tomentose. *Stipules* .9–1.3 cm. long, about .6 cm. broad, ovate, acuminate, brown, membranous, glabrous. *Leaves* petioled, 2–10 cm. long; petiole .5–2.3 cm. long, terete, tomentose; lamina 2–8.5 cm. long, .8–4.4 cm. broad, ovate, oblong, elliptic, ovate-elliptic or ovate-oblong, obtuse, rounded or cordate at the base, with crenate margins, stellately tomentose beneath, glabrous or scantily stellately hairy above. *Flowers* axillary along the stem, 1–2-nate. *Peduncles* up to 5.5 cm. long, rarely less than 3 cm. long, terete, tomentose. *Bracts* about 1 cm. long, linear or ovate-linear, tomentose. *Calyx-tube* .5–1 cm. long, more or less campanulate, distinctly 10-nerved within, tomentose without; lobes 5–7 mm. long, very rarely less than 5 mm. long, ovate, subacuminate, acute, 3-nerved, and tomentose within and without. *Corolla* white, cream or yellow. *Petals* 2 cm. long, 7–8 mm. broad, elliptic or ovate above, obtuse, and narrowed in the lower half to a concave 9-nerved pubescent claw. *Stamens* 5, adnate at the very base; filaments .8–1 cm. long, linear, widened into two processes about the middle; processes covered with stellate hairs; anthers 7 mm. long, produced into a fine subulate point, sparsely pubescent with a few stiff hairs. *Ovary* subsessile, 6 mm. long, elliptic in outline, obtusely 5-angled, tomentose; style 7 mm. long, terete, glabrous; stigma simple. *Planch. in Herb. Hook. ex Harv. Fl. Cap.* I, 218; *M. betonicaefolia*, *E. & Z. ex Harv., l. c.*; *Hermannia geniculata*, *E. & Z., l. c.*; *Melhania chrysantha*, *E. Mey. in Zwei Pflanzengeogr. Document*, p. 201.

Stockenstroom Division, Kat River, near Balfour, *E. & Z.* 320; Albany Division, Grahamstown, *Miss M. Daly*, 734; Sheldon, *Mrs. H. Hutton*, 501; Kaffraria, *Cooper*, 347; Somerset East Division, *MacOwan*, 1217; near Cookhouse, *L. Kensit in Herb. Bolus*, 9312; Queenstown Division, near Shiloh, *Drège*; Zwarte Kei River, *E. & Z.*, 321; Bechuanaland, *Burke*, 158; Orange Free State, near Harrismith, *Wood*, 4723; Basutoland, Leribe, *Madame A. Dieterlen*, 43a, 43b; Phillips, 821; Tembuland, Cala commonage, *Miss A. Pegler*, 1628; Bashee River, Collector? 8805; Griqualand East, Clydesdale, *Tyson*, 1635 *ex parte*.

*M. cordata* (*E. Mey in Zwei Pflanzengeogr. Document*, p. 200). *Stem* terete, tomentose. *Stipules* .6–1.2 cm. long, ovate or lanceolate, acuminate, sometimes 3-toothed, tomentose. *Leaves* petioled, 2.5–7 cm. long; petiole .8–1.5 cm. long, terete, tomentose; lamina



1·5–6 cm. long, ·8–5 cm. broad, ovate, elliptic or elliptic-ovate, obtuse, cordate at the base, with crenate margins, stellately tomentose below, scantily stellate hairy above. Flowers in terminal panicles. *Pedicels* ·6–1·2 cm. long, terete, tomentose. *Bracts* about 5 mm. long, linear, tomentose. *Calyx-tube* 4–5 mm. long, more or less campanulate, glabrous and usually 5-nerved within, tomentose without; lobes 2–3 mm. long, ovate, acuminate, acute, tomentose without, glabrous within. *Corolla* yellow. *Petals* ·9–1 cm. long, 4 mm. broad, broadly ovate above, rounded at the apex, narrowed in the lower half, the narrow portion being concave, tomentose, and 3-nerved. *Stamens* 5, adnate at the very base; filaments 4·5 mm. long, linear, widened into two processes above the middle of their lengths; processes covered with stellate hairs; anthers 3·5 mm. long, acuminate, acute, ciliate with a few short hairs. *Ovary* shortly stalked, 2·5–3 mm. long, obovate in outline, obtusely 5-angled, tomentose; style 1 cm. long, terete, glabrous; stigma simple.

Stormberg, *Drège*; Transvaal, Hoog Veld above Irene, *Burt-Davy*, 31; Heidelberg, *Schlechter*, 3534; Orange Free State, Bester's Vlei, Harrismith, *Bolus*, 8127, *Cooper*, *Flanagan*, 1884, Caledon River *Burke*; Basutoland, Leribe, *Madame A. Dieterlen*, 47; Griqualand East, Clydesdale, *Tyson*, 1635 *ex parte*.

## TILIACEAE.

### GREWIA, *Linn.*

#### *G. occidentalis*, *Linn.*

Mountain slopes. 3–8 ft. high, flowers violet. Summer. *A. Dieterlen*, 357!

DISTRIBUTION: S.W. Africa, Cape. Uitenhage. Albany. Cradock. Komgha. Natal. Transvaal (Potatobosch).

SESUTO: *Lesika*. Sinew of an ox, or a thread made of sinews of cattle. So called on account of the long fibres in the bark. Wood used to lance or scarify and for making pegs. Also used medicinally.

#### 2. *G. hispida*, *Harv.*

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8129!; Eland's River Valley, near Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2016!

DISTRIBUTION: Natal.

CORCHORUS, *Linn.***C. asplenifolius**, Burch.

Thaba Unchu, *Zeyher*, 148! 417!

DISTRIBUTION: East Griqualand. Natal. Hope Town. Orange Free State (near Parys, near Modder River). Transvaal (Rustenburg, Barberton). Bechuanaland (Kuruman, Mafeking). Rhodesia (Victoria Falls).

## LINEAE.

LINUM, *Linn.***L. Thunbergii**, E. & Z.

Damp spots on mountain slopes. 7–20 in. high, flowers yellow, Summer. *A. Dieterlen*, 444!; damp spots near stream on plateau, flowers yellow, *Phillips*, 794!, Lefi's Kloof, N.E. slopes of Leribe plateau, *Phillips*, 843!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8130!

DISTRIBUTION: Tulbagh. Cape. George. Uitenhage. Albany. Graaff Reinet. Aliwal North. Komgha. Transkei. Tembuland. Pondoland. Natal. Transvaal (Middelberg). Swaziland.

SESUTO: *Bohlōkvana*. The small pain. Used in medicine to relieve pain and as a cure for snake-bite. A charm to prevent accidents befalling huts and cultivated lands.

## ZYGOPHYLLACEAE.

TRIBULUS, *Linn.***T. terrestris**, *Linn.*

Veld and mountain slopes. 6–25 in. high, flowers yellow. Summer. *A. Dieterlen*, 127!

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Clanwilliam. Cape. Uitenhage. Murraysburg. Graaff Reinet. Natal. Calvinia. Griqualand West (Herbert). Bechuanaland (Mafeking). Rhodesia (Bulawayo).

SESUTO: *Tsehlo*. Meaning unknown. Used together with *Andropogon contortus* for rheumatism.

GERANIACEAE.

MONSONIA, *Linn.*

**M. biflora**, DC.

Veld and mountain slopes. 4–15 in. high, flowers white or mauve, March. *A. Dieterlen*, 82! 82a!; south slopes of Leribe plateau, above Khaniane, flowers white, *Phillips*, 860!; Qoqolosi Peak, flowers white, *Phillips*, 961!; Caledon River, *Zeyher*, 300! Tsita footpath, Drakensbergen, 6900 ft., March, *Galpin*, 6590.

DISTRIBUTION: S.W. Africa. Graaff Reinet. Herbert. Aliwal North. East Griqualand. Natal. Orange Free State (Bloemfontein). Transvaal (Rustenburg, Pietersburg, Aapies River, Middleberg.) Bechuanaland (Mafeking).

SESUTO: *Marōrōtsvane*. Used as a medicine for dysentery and sore eyes.

**M. attenuata**, Harv.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8131!; Van Reenen, 6000 ft., *Schlechter*, 6989!

DISTRIBUTION: Natal. Orange Free State. Transvaal (Barberton).

**M. brevirostrata**, R. Kunth.

Mountain slopes, 4–12 in. high, flowers mauve, summer, *A. Dieterlen*, 714!

DISTRIBUTION: Tembuland. East Griqualand.

SESUTO: *Mokhankha*. He who smells odours. *Makōrōtsvane*. Use unknown

**M. longipes**, R. Kunth (*ex descr.*).

Bester's Vlei, near Witzie's Hoek, 5400–5500 ft., December–January, *Bolus*, 8132! *Flanagan*, 2086!

DISTRIBUTION: Riversdale.

GERANIUM, *Linn.*

**G. incanum**, Linn.

Damp spots on veld and in dongas. 8–15 in. high, flowers white or mauve-pink. November. *A. Dieterlen*, 316!; Giant's Castle, *Alf. Bolus in Herb. Bolus*, 6874!

DISTRIBUTION: Cape. George. Humansdorp. Uitenhage. Albany. Molteno. Murraysburg. Natal.

SESUTO: *Ngope-setšōha*. See *G. canescens*, L'Her. *Tlaka*. Scorn, mockery. *Tee*. Tea. Used by some of the natives for making a kind

of tea. The witch-doctors use this plant when working the divining bones. If one of the bones falls in a certain direction the doctor sees in it a proof that the sick person whom he is attending is troubled in his mind, and he prepares his drugs accordingly to quiet him. Also used to make milk produce much cream. When the milk of a cow is watery a bunch of this plant is thrown in the clay pot containing the milk, and the natives believe that it will make the milk creamy. Also used to get rid of internal worms called "Kopane," supposed to infest the big intestine.

**G. canescens**, L'Her.

Shaded spots on mountain slopes. 15-30 in. high, flowers mauve. Summer. *A. Dieterlen*, 593!; ravine on south slopes of Leribe plateau above Khaniane, flowers white, *Phillips*, 863!; shady spots under trees, ravine west slopes of Leribe plateau, *Phillips*, 748!; summit of Mont-aux-Sources, 9500 ft., *Flanagan*, 2017!

DISTRIBUTION: Albany. Natal.

SESUTO: *Lehloele*. Clot. *Ngope-setšoha*. Something which happens unexpectedly. Used in cases of dysentery.

**G. ornithopodum**, E. & Z.

Mountain slopes, Malaoaneng. Flowers pinkish-mauve. December. *A. Dieterlen*, 950!; shaded spots on mountain slopes, 5-25 in. high, flowers pale mauve, summer, *A. Dieterlen*, 544!; Mont-aux-Sources, 6000 ft., October, *A. Bolus in Herb. Bolus*, 6876!; Bester's Vlei, near Harrismith, 6200 ft., December, *Bolus*, 8133!

DISTRIBUTION: Cape. Albany. Molteno. King William's Town. Stockenström. Tembuland. East Griqualand. Natal. Transvaal (Barberton, Pilgrim's Rest).

SESUTO: *Bohila ba thaba*. Sorrel or sourness of the mountain. *Makorotsvane*. Meaning unknown.

Used to cure children suffering with a cold in the head. The leaves are bruised and mixed with water, the nose and nostrils are rubbed with the lotion, to make the child sneeze.

**G. cafferum**, E. & Z.

Mountain slopes. 10-20 in. high, flowers cream and crimson. Summer. Sebothvane. Leribe District. *A. Dieterlen*, 712!

DISTRIBUTION: Beaufort West. Molteno. Aliwal North. Stockenström. Tembuland. Natal. Transvaal (Belfast).

SESUTO: *Khoaara*. See *Pelargonium Bowkeri*, Harv. *Makorotsoane*. Meaning unknown.

**G. languinosum**, R. Kunth.

Giant's Castle, Drakensbergen, *Alf. Bolus in Herb. Bolus*, 6875!

DISTRIBUTION: East Griqualand,

**G. pulchrum**, N. E. Br.

Natal, on the Drakensbergen, in swamps, 6-7000 ft., January, *Evans*, 378.

DISTRIBUTION: Endemic.

**G. Thodei**, R. Kunth.

Doodman's Krans Mountain, 9650 ft., March, *Galpin*, 6591!; summit Mont-aux-Sources, 9500 ft., *Flanagan*, 2017!; grassy spots on summit Mont-aux-Sources, c. 8850 ft., January, *Thode*, 4!

DISTRIBUTION: Endemic.

PELARGONIUM, *L'Her.*

**P. pulverulentum**, Colv.

Tsita footpath, Drakensbergen, 6900 ft., March, *Galpin*, 6592.

DISTRIBUTION: Transkei. Pondoland. Tembuland.

**P. aconitophyllum**, Harv.

Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8134!

DISTRIBUTION: Transkei. Tembuland. Natal.

**P. caffrum**, E. & Z.

Bester's Vlei, near Witzie's Hoek, 5500 ft., *Flanagan*, 1990!

DISTRIBUTION: Natal.

**P. myrrhifolium**, Ait.

Makhvarane Mountain, Morija. 12-25 in. high, flowers pink. April. *A. Dieterlen*, 989!

DISTRIBUTION: Van Rhynsdorp. Cape. Worcester. George. Port Elizabeth. Transvaal (Pietersburg).

SESUTO: *Bolila ba thaba*. The sorrel of the mountain. *Maköröts-vane*. Use unknown.

**P. grossularioides**, Ait.

Mountain slopes and plateau. 4-18 in. high, flowers mauve-pink. Spring. *A. Dieterlen*, 738!; roadside in Caledon Pass, near the river, 6900 ft., flowers pink, January, *Thode*, 5!; slopes of Mont-aux-Sources, 7000 ft., January, *Flanagan*, 2104!

DISTRIBUTION: Namaqualand Minor. Malmesbury. Tulbagh. Cape. Caledon. George. Oudtshoorn. Uitenhage. Alexandria. East London. Murraysburg. Komgha.



SESUTO: *Makörötsvane*. *Khoaara*. See note under *P. reniforme*, Sims.

**P. fumarioides**, L'Her.

Garden of the Residency, Peka. Leribe District. Flowers whitish. April. *A. Dieterlen*, 1000!; Caledon River, *Burke*!

DISTRIBUTION: Namaqualand Minor. Murraysburg. Graaff Reinet. Orange Free State (Bethulie).

SESUTO: *Makörötsvane o manyenyane*. The small "*Makörötsvane*."

**P. alchemilloides**, Willd.

Mountain slopes. Flowers mauve. December. Malavaneng, Leribe District, *A. Dieterlen*, 951!; near Buffalo River Waterfall, 8300 ft., March, *Galpin*, 6593!

DISTRIBUTION: King William's Town. Komgha. Tembuland. Natal.

SESUTO: *Bolila ba thaba*. The sorrel of the mountain. *Makörötsvane*.

var. **dentatum**, Harv.

Mountain slopes. Flowers pinkish. January. *A. Dieterlen*, 246b!

DISTRIBUTION: Caledon. Uitenage. Albany. Murraysburg. Komgha. Tembuland. East Griqualand.

SESUTO: *Bolila ba litsoëne*. The sorrel (or sourness) of the monkeys. *Bolila ba thaba*. Sorrel (or sourness) of the mountain. A lotion is made from the cooked roots, with which feverish people are washed.

var. **aphanoides**, Harv.

Shady spots on mountain slopes and ravine. 8-30 in. high, flowers pale mauve. Summer-autumn. *A. Dieterlen*, 246a!

DISTRIBUTION: Uitenhage. Philipstown. Graaff Reinet.

SESUTO: See var. *dentatum*.

**P. reniforme**, Sims.

Mountain slopes, 8-20 in. high, flowers dark and light crimson. Summer. *A. Dieterlen*, 367!; Qoqolosi Peak, flowers dark purple, *Phillips*, 974!

DISTRIBUTION: Uitenhage. Port Elizabeth. Albany. Graaff Reinet. Murraysburg. Cradock. Aliwal North. Komgha. Tembuland. East Griqualand. Transvaal (Oliphant's River).

SESUTO: *Khvaara e nyenyane*. The small "*Khvaara*." The word "*Khvaara*" means to climb a mountain which has no path in the stony patches; this plant is found growing on such stony patches. Used medicinally for colic.

**P. Bowkeri**, Harv.

Mountain and hill slopes. 6-20 in. high, flowers dark crimson. Spring. *A. Dieterlen*, 99!; mountains round Bester's Vlei, 6000 ft., December, *Bolus*!

DISTRIBUTION: Komagh. Transkei. Natal.

SESUTO: *Khvaara*. Derived from "lekhvaara"—a stony ridge. This plant is usually found growing near stones or rocks. See also *P. reniforme*, Sims. The green leaf is eaten by children; they call it "bolila"—Sorrel. The dried roots are used by the Bushmen for making a kind of pap for their babies. Used medicinally for flushings, colic and diarrhoea.

**P. dispar**, N. E. Br.

Bushy banks of a rivulet, lower slopes of Auqua Mtn., Witzie's Hoek, c. 6000 ft., March, flowers whitish, strongly scented, *Thode*, 6!; Natal, Tiger Cave Valley, 6-7000 ft., among grass, January, *Evans*, 371.

DISTRIBUTION: Natal.

**P. Schlechteri**, R. Kunth.?

Eland's River Valley at the foot of Mont-aux-Sources, 6800 ft., December, *Flanagan*!

DISTRIBUTION: Tembuland.

OXALIS, *Linn.*

**O. convexula**, Jacq.

Veld and mountain slopes. 3-6 in. high, flowers pink-mauve. Summer-Autumn. *A. Dieterlen*, 170!; ravine, flowers pink, base of corolla yellow, *Phillips*, 767, south slopes of Leribe plateau above Khaniane, *Phillips*, 925!; Bester's Vlei, near Harrismith, 5400 ft., December, *Bolus*, 8135! near Witzie's Hoek, 5500 ft., *Flanagan*, 1936! Caledon River, *Burke*, 441!; Natal, upper Tugela, 4000 ft., January, *Wood*, 3505!

DISTRIBUTION: Cape. Komgha. Albany. Port Elizabeth. Ceres. Queenstown. Transkei. Tembuland. Orange Free State (Bloemfontein).

SESUTO: *Bolila*. Sorrel or sourness. See *O. Smithii*, Sond. *Phillips* 925 is an exact match with *Burke* 441 labelled by Harvey in our Herbarium *O. convexula*, Jacq., but differs from the description in the 'Flora Capensis' in the peduncles not being bracteate and the sepals not ciliate.

Mr. F. Bolus, who is revising the genus *Oxalis*, reports on the

above specimens as follows: *O. convexula*, Jacq. *Phillips*, 767, *Burke*, 441. *O. convexula*, Jacq. var. *pubescens*. *Dieterlen*, 170, *Flanagan*, 1936. *O. convexula*, Jacq. var. *hispida*. *Wood*, 3505.

***O. setosa*, E. Mey.**

Tsita footpath, Drakensbergen, 6900 ft., March, *Galpin*, 6596!; in valley at base of Doodman's Krans, c. 8500 ft., March, flowers pink. *Galpin*, 6594!

DISTRIBUTION: Natal. Transvaal (Belfast). Rhodesia (Gwelo).

***O. Smithii*, Sond.**

Under rocks or shrubs on mountain slopes and ravines. 3-13 in. high, flowers pink to mauve. March. *A. Dieterlen*, 540! 879!

DISTRIBUTION: Uitenhage. Albany. Komgha. Natal. Transvaal. (Barberton).

***O. corniculata*, Linn.**

Mountain slopes. 2-16 in. high, flowers yellow. Spring-Autumn. *A. Dieterlen*, 171!; south slopes of Leribe plateau above Khaniane, flowers yellow, *Phillips*, 915!

DISTRIBUTION: Cape. Albany. Somerset East. Aliwal North. Komgha. Tembuland. Natal. Transvaal (Rustenburg).

SESUTO: *Bolila ba thaba*. Sorrel (or sourness) of the snakes. A medicine for snake-bite. The bitten limb is washed with water mixed with this plant and a ligature tied above the bite. The patient must be carried across a stream, as the injured portion of the body must not touch water, otherwise the wound will smell.

## ERODIUM, L'Her.

***Erodium cicutarium* ? L'Her.**

Veld and mountain slopes. 3-20 in high, flowers mauve. Spring. *A. Dieterlen*, 642!

DISTRIBUTION: An introduced weed.

SESUTO: *Makorotsvane*.

## OLACINEAE.

### CASSINOPSIS, Sond.

***C. capensis*, Sond.**

Mountain slopes and ravines. Tree, 8-12 ft. high, flowers green. Summer. *A. Dieterlen*, 345!; tree, frequent, *Phillips*, 596!

DISTRIBUTION: Swellendam. Somerset East. King William's Town. Komgha. Natal. Transvaal (Barberton, Fountain Grove, Elandspruitbergen).

SESUTO: *Motale*. The green one. So named because it is an evergreen tree. Used for building huts.

## ILICINEAE.

### ILEX, Linn.

#### *I. capensis*, Sond. & Harv.

Mountain slopes and ravines. Tree, flowers cream. Spring-Summer. Thaba Phatsoa, Leribe District, *A. Dieterlen*, 62!; Leribe, *A. Dieterlen*, 392!; ravine on west slopes of Leribe plateau, occasional, *Phillips*, 726!

DISTRIBUTION: Worcester. Cape. Stellenbosch. Swellendam. Port Elizabeth. Albany. Komgha. Stutterheim. Transkei. King William's Town. Natal. Transvaal (Botsabelo, Barberton, Zoutpansberg). Rhodesia (Mazoe).

SESUTO: *Molōō a phofu*. The bleating of the eland. *Phuklu*. Derived from the verb "ho phukha"—to break easily. Used for firewood. Employed by the witch-doctors in conjunction with the divining bones to prevent a sick person being bewitched. Given as an enema to children suffering from colic.

## CELASTRINEAE.

### GYMNOSPORA, Wight & Arn.

#### *G. (Celastrus) peduncularis*, Sond.)

Bester's Vlei, near Witzie's Hoek, 5600 ft., December, *Bolus*, 8136!

DISTRIBUTION: Albany. Stutterheim. King William's Town. Komgha. Natal.

According to Galpin used by Kaffirs for making fighting-sticks.

#### *G. acuminata*, Szysz. (*C. acuminatus*, Linn.)

Mountain slopes and ravines. Tree, flowers greenish. Spring. Thaba Phatsoa, Leribe District, *A. Dieterlen*, 553!

DISTRIBUTION: Cape. Stellenbosch. Caledon. Swellendam. Port Elizabeth. Albany. King William's Town. Komgha. Transkei. Tembuland. Natal. Swaziland.

SESUTO: *Tsikane*. Derived from "litsika"—threads. *Tepo*. Glue.

Derived from the verb "ho lepoloha"—to trickle down. The wood is used for making walking sticks; it contains a sticky substance. The bark is used for building huts.

**G. (*C. buxifolius*, Linn.)**

Mountain slopes and ravines. Bush or small tree, 3–10 ft. high, flowers white or cream. Summer. *A. Dieterlen*, 75a! 75b!; Ravine on west slopes of Leribe plateau, tree 12–15 ft. high, *Phillips*, 722! Only a few specimens were seen.

DISTRIBUTION: S.W. Africa. Clanwilliam. Tulbagh. Cape. Swellendam. Uitenhage. Albany. Graaff Reinet. Oudtshoorn. King William's Town. Komgha. Transkei. Natal. Transvaal (Pretoria, Irene, Barberton).

SESUTO: *Sefea-maeba*. "Sefea" means strong in throwing stones, "maeba" is a rock dove. There is no explanation as to why the plant is so called. *Sefea-maeba se senyenyane*. The small "sefea-maeba." Mixed with parts of snakes it is used medicinally as a cure for snake-bite.

**G. (*C. albatus*, N. E. Br.)**

Mountain slopes and ravines. Tree, flowers green. Spring. *A. Dieterlen*, 285!; Van Reenen, 5500 ft., November; Wood, 6362!

DISTRIBUTION: Transvaal (Potatobosch).

SESUTO: *Moqai*. Meaning unknown. The wood of this tree is much appreciated for making sticks and knobkerries. Young men who cannot obtain the wood yet call their sticks "Moqai," pretending that they have been made from this tree.

## RHAMNEAE.

### RHAMNUS, *Linn.*

**R. prinoides, L'Her.**

Mountain slopes and ravines. Bush, 7–12 ft. high, flowers green. Summer. *A. Dieterlen*, 79!; ravine on west slopes of Leribe plateau, tree, leaves shining green above, pale beneath, *Phillips*, 742!

DISTRIBUTION: Swellendam. George. Port Elizabeth. Graaff Reinet. Somerset East. Aliwal North. King William's Town. Komgha. Transkei. Natal. Transvaal (Pretoria). Rhodesia (Broken Hill).

SESUTO: *Nofifi*. Darkness. So called on account of the dark green leaves. Branches of this plant are placed on the top of huts, in cattle kraals, or in the "Lekhotla" (the court) to prevent harm befalling the inmates.



AMPELIDEAE.

RHOICISSUS, *Planch.*

**R. (Cissus) cuneifolia**, *Planch.*

Mountain slopes, trailing on rocks or shrubs, flowers yellowish-green. Summer. *A. Dieterlen*, 83!; growing under cliffs on west slopes of Leribe plateau, *Phillips*, 620!

DISTRIBUTION: Uitenhage. Albany. Somerset East. King William's Town. Komgha. East Griqualand. Natal. Orange Free State (nr. Parys). Transvaal (Crocodile and Magalies Rivers). Bechuanaland. Rhodesia (Gwelo).

SESUTO: *Morara*. The creeper. The fruits are eaten by children in late autumn. The plant is cooked and drunk by sterile women in order to become pregnant. Also used as a charm by a chief when he establishes a new village.

SAPINDACEAE.

MELIANTHUS, *Linn.*

**M. villosus**, *Bolus*.

Eland's River Valley, near Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2004!; on a rocky hill, Weenen County, 4-5000 ft., December, *Wood*, 4376!

DISTRIBUTION: Endemic.

GREYIA, *Hook & Harv.*

**G. Sutherlandi**, *Hook. & Harv.*

Bester's Vlei, near Witzie's Hoek, 5700 ft., December, *Bolus*, 8137!

DISTRIBUTION: Stutterheim. Tembuland. Natal. Orange Free State. Transvaal (Slangapie Mtns., Macamac).

ANACARDIACEAE.

RHUS, *Linn.*

**R. discolor**, *E. Mey.*

Mountain slopes. 1-3 ft. high, flowers yellowish. Summer. *A. Dieterlen*, 29! 29b!; slopes of ravine between the Mission Station and Jonathan's village, common, *Phillips*, 551!; low bush, 9-12 in. high, common, *Phillips*, 614! 844!; Bester's Vlei, near Witzie's Hoek, 5500 ft., *Flanagan*, 1864! December, *Bolus*, 8138!

DISTRIBUTION: Komgha. Tembuland. Natal. Orange Free State. Transvaal (nr. Carolina, Irene, Lydenburg, Houtbosch).

SESUTO: *Kopshsvane* or *Kopshane*. Meaning unknown. *Mohlohlvane*. The thick part or swelling in a root. In autumn the natives make fires with this plant in the cultivated lands with the idea that a good crop will result. As the fruits are thickly clustered and brightly coloured, they think these properties will be imparted to their crops. *Lantana salviaefolia* is used for the same purpose. The fruits are said to cause constipation.

**R. divaricata**, E. & Z.

Mountain slopes. Shrub, flowers whitish. Summer. *A. Dieterlen*, 17! 17b!

DISTRIBUTION: Queenstown.

SESUTO: *Kolitsāne*. *Kolitsāna*. The same word, derived from "koli"—a blot, and "tsane"—small. The wood is used for making strong knobkerries. As a medicine, it is mixed with *Scabiosa columbaria*, Linn., and *Cussonia paniculata*, E. & Z. Used in cases of colic. The witch-doctors employ this plant for rain making.

**R. pyroides**, Burch.

(Leribe, *A. Dieterlen*, 17!). Leribe Mountain. Shrub, 5–8 ft. high, flowers cream. Summer. *A. Dieterlen*, 17c!; Ravine on west slopes of Leribe plateau. A bush, *Phillips*, 753!

DISTRIBUTION: Knysna. Uitenhage. Natal.

SESUTO: *Kolitsane*. See *R. divaricata*, E. & Z.

**R. dentata**, Thunb.

Mountain slopes. Shrub, flowers cream. Spring-Summer. *A. Dieterlen*, 76b!; mountain slopes behind the Mission Station, a low bush, not uncommon, *Phillips*, 527!; ravine on west slopes of Leribe plateau, frequent, *Phillips*, 581! without precise locality, *Cooper*, 750!; Wittebergen, 4–5000 ft., *Drège*.

DISTRIBUTION: Uitenhage. Albany. Graaff Reinet. Komgha. Transkei. Tembuland. East Griqualand. Natal. Transvaal (Ermelo).

SESUTO: *Mabelebele*. Much grain, derived from "mabele"—grain. The red berries, as well as those of *R. Sonderi*, Engl. var., are eaten freely.

**R. erosa**, Thunb.

Mountain slopes and ravines. Shrub, flowers yellow. Summer. *A. Dieterlen*, 78!; mountain slopes behind the Mission Station, *Phillips*,

526 !, Lefi's Kloof, N.E. slopes of Leribe plateau, frequent, *Phillips*, 842 !, south slopes of Leribe plateau, above Khaniane, *Phillips*, 892 !

DISTRIBUTION : Queenstown. Cradock. Murraysburg. Tembuland.

SESUTO : *Tšilabelo*. *Ntsilabelo*. *Tsilabele*. The three names applied to this plant are derived from the verb "hotsila"—to smell, and "mabele"—grain. Branches are used for making brooms and building enclosures. Used by the witch-doctors for rain making and as a medicine for diarrhœa in men and cattle.

**R. Zeyheri**, Sond.

Mountain slopes. Shrub, flowers whitish. Summer. *A. Dieterlen*, 17a !

DISTRIBUTION : Transvaal (Pretoria, Magaliesberg).

SESUTO : *Kolitsana*. See *R. divaricata*, E. & Z.

**R. viminalis**, Vahl. var. **Gerrardi**, Engl.

Mountain slopes and ravines. Tree, flowers yellow. Summer. Khanyane, Leribe District. *A. Dieterlen*, 691 !

DISTRIBUTION : Natal.

SESUTO : *Mosilabele*. See *R. erosa*, Thunb. Used for building huts.

**R. dregeana**, Sond.

Near Buffalo River Waterfall, 7130 ft., March, *Galpin*, 6599 !

DISTRIBUTION : Mooiplaats. (Legit, *Drege*).

**R. lucida**, Linn.

Bushman's River Valley, 6-8000 ft., *Wood*, 10635 !

DISTRIBUTION : Cape. Caledon. Riversdale. Albany.

**R. Burchellii**, Sond.

Mountain slopes and ravines. 2-4 ft. high, flowers yellowish. Summer, *A. Dieterlen*, 581 !

DISTRIBUTION : S.W. Africa. Clanwilliam. Murraysburg. Aliwal North.

SESUTO : *Mokhoa-phiri* or *Mokhoa-mphiri*. Derived from the verb "ho Khoaphi ritsa"—to scratch (the plant being thorny). The Sesuto names are the same word pronounced differently, as *e. g.* Ellen, Helen.

**R. Sonderi**, Engl. var. **pilosa**, Engl.

Mountain slopes. Shrub, flowers cream. Spring-Summer. *A. Dieterlen*, 76a !

DISTRIBUTION : Komgha. Transvaal (Pretoria).

SESUTO : *Mabelebele*. See *R. dentata*, Thunb.

**R. sp.**

Mountain slopes. Cream flowers. December. *A. Dieterlen*, 962!

SESUTO: *Kopshvane*. Meaning unknown.

I cannot match this either in our Herbarium or in the Bolus Herbarium. The material is too scanty to describe.

SMODINGIUM, *E. Mey.***S. argutum**, *E. Mey.*

Slope of Leribe Mountain near the Matalane Ravine. Shrub, 6 ft. high, flowers cream. November. *A. Dieterlen*, 1007!; Natal.

Polela, 5000 ft., *Wood*, 967! 6–7000 ft., *Evans*, 634!

DISTRIBUTION: Transkei. Pondoland.

SESUTO: *Tšilabelo e Kholo*. The big “Tsilabelo.” Branches used to make enclosures.

## LEGUMINOSAE.

PLEIOSPORA, *Harv.***P. grandifolia**, *Dümmer*,

Side of a grassy hill, Van Reenen, December, *Wood*, 4516.

DISTRIBUTION: Orange Free State (no locality).

LOTONONIS, *DC.***L. Wyliei**, *Wood*.

Natal. Tabamblope, 6000 ft., October, *Wood*, 10651 (or 7)!; Montaux-Sources, c. 7200–8100 ft., *Evans*, 753.

DISTRIBUTION: Zululand.

**L. Galpinii**, *Dümmer*.

Summit and upper eastern slopes of the Drakensbergen from Tsitsa Footpath to Satsanna Berg, 7850–9650 ft., March, *Galpin*, 6600! 6601!.

DISTRIBUTION: Endemic.

**L. minor**, *Dümmer & Jennings*.

Doodman's Krans Mtn., 9000 ft., March, *Galpin*, 6602 also source of the Tina River, 8750 ft., March, *Galpin*, 6602!.

DISTRIBUTION: Endemic.

**L. procumbens**, *Bolus*.

Bester's Vlei, near Witzie's Hoek, 5400–6400 ft., December, *Bolus*, 8139! *Flanagan*, 2094! *Sankey*, 44.

DISTRIBUTION: Endemic.

**L. eriantha**, Benth

Basutoland, without precise locality, *Cooper*, 2269; Van Reenen, 5500 ft., December, *Wood*, 4525; Olivier's Hoek Pass, c. 5000 ft., *Wood*, 3602.

DISTRIBUTION: Transvaal (Magaliesberg, Houtbosch, near Lydenburg).

var. **obovata**, Scott-Elliot.

Mountain slopes and plateau. 6-15 in. high, flowers yellow. Summer. *A. Dieterlen*, 65!

DISTRIBUTION: Tembuland. East Griqualand. Natal.

SESUTO: *Molomo o monate*. Good mouth. A Basuto before visiting a chief bathes in water in which a bruised or crushed plant has been dipped, or a bit of the plant is chewed, the belief being that it will bring luck and act as a charm in obtaining the favours of the chief or other important person visited. It is said to give a "good mouth" in speaking in such a way as to fascinate the chief.

**L. foliosa**, Bolus.

Drakensbergen, 4-5000 ft., January, *Wood*, 3542; Bester's Vlei near Witzie's Hoek, 5300 ft., December, *Bolus*, 8140!; Harrismith, *Sankey*, 46.

DISTRIBUTION: Zululand. Swaziland. Transvaal (near Pretoria, Pilgrim's Rest).

**L. lanceolata**, Benth.

Ravines and mountain slopes. 10-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 437!; Wittebergen, *Drège*!

DISTRIBUTION: Transvaal (nr. Johannesburg). Zululand.

SESUTA: *Khonathi*. *Khonathe*. *Khonatse*. Derived from the verb "ho Khonathela"—to adhere to. An adhesive preparation is made from the roots and which is used to stop diarrhoea. It is either drunk or taken as an enema.

**L. crumania**, Burch.

Basutoland, near sources of the Kuruman River at Little Klibbobbikhonni, *Burchell*, 2445, 2472; Caledon River, *Burke & Zeyher*, 405; *Burke*.

DISTRIBUTION: Endemic.

**L. laxa**, E. & Z.

Mountain slopes. 3-10 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 654b!; Thaba Unchu and Caledon River. *Burke, Zeyher*, 393, 401, 402.



DISTRIBUTION: Albany. Queenstown. Graaff Reinet. Colesburg. Albert. Transkei. Natal. Transvaal (Pretoria).

SESUTO: See *L. Woodii*, Bolus.

Madame Dieterlen's specimen is a narrow-leaf form.

**L. Woodii**, Bolus (= *L. montana*, Schinz).

Mountain slopes. 3-10 in. high, flowers yellow. Spring. *A. Dieterlen*, 654a!; Qoqolosi Peak, small shrub, flowers yellow, *Phillips*, 942!; grassy slopes of Matela's Peak, 7200 ft., January, *Thode*, 10!; Harri-smith, c. 5000 ft., *Wood*, 4788; Mahwaga, 6-7000 ft. April, *Wood*, 4603.

DISTRIBUTION: Alexandria. Albany. Queenstown. Transvaal (Standerton).

SESUTO: *Musapelo oa matlapa o monyenyane*. The small comforter of the stony ridges (or of the flat stones).

This plant has all the appearance of an *Argyrolobium*, but the characters of the calyx and the turgid legume would place it in the genus *Lotononis*. Schinz in Bull. Herb. Boiss. vii. 30 described it as *L. montana* on the specimen *Wood*, 4603 (this description appeared three years later than Bolus'), and remarks "the plant was originally marked as an *Argyrolobium*, and will be found in most collections under that genus; the structure of the calyx makes the position there impossible, although it certainly in habit recalls several of the prostrate *Argyrolobiums*. *Phillips*, 942, is a form of the species with smaller leaves which are silvery white.

**L. tenella**, E. & Z. var. **glabra**.

Bester's Vlei, near Harrismith, 6000 ft., December, *Bolus*, 8141!; Natal, Van Reenen, 5-6000 ft., March, *Wood*, 6033! 6704!

DISTRIBUTION: Aliwal North. Tembuland. Transvaal (Belfast).

**L. versicolor**, Benth.

Veld and mountain slopes. A creeping plant, 10-20 in. long, flowers yellow. Summer. *A. Dieterlen*, 519b!

DISTRIBUTION: Uitenhage. Albany.

SESUTO: *Senamanama se Sehelo*. The big one who creeps. Mixed with other plants and given in milk to children for bronchitis.

**L. Rehmannii**, Dümmer (*ex descr.*).

Leribe, *A. Dieterlen*, 280a!

DISTRIBUTION: Transvaal (Hooge Veld).

SESUTO: See *L. calycina*, Benth. for name and uses.

**L. ornata**, Dümmer (*ex descr.*).

Dry and stony places on veld and in dongas, 1½-10 in. high, flowers

bright yellow. Early Spring. *A. Dieterlen*, 519a!; Basutoland, without precise locality, *Cooper*, 745.

DISTRIBUTION: Endemic.

SESUTO: *Senamanana*. He who creeps. Mixed with other plants it is used as a cure for bronchitis in children.

***L. calycina*, Benth.**

Veldt and mountain slopes, 5–10 in. high, flowers yellow. Summer.

*A. Dieterlen*, 280!; Thaba Unchu, *Burke*, 436.

DISTRIBUTION: Uitenhage. Somerset East. Albany. Stocken-stroom. King William's Town. Komgha. Pondoland. Natal. Zululand.

SESUTO: *Nomele*, from "ho nama"—to extend, to spread, to be stretched. Mixed with other plants, especially *L. versicolor*, Benth., it is used as a preparation in the cure of bronchitis in children.

***L. basutica*, Phillips, sp. nov.** (§ Leptis.) *Planta* pusilla. *Radix* plus quam 20 cm. longa, 1 cm. lata. *Rami* pubescentes. *Folia* trifoliolata, stipulata, petiolata, 1–4 cm. longa. *Stipulae* solitariae, 4–8 mm. longae, 1·5–3 mm. latae, ovatae, lanceolatae vel oblanceolatae, subacuminatae, apice acutae, pubescentes. *Foliola* 1–3·2 cm. longa, ·3–1·2 cm. lata, elliptica, lanceolata, lanceolato-elliptica vel oblanceolato-elliptica, apice acuta vel obtusa, pubescentia. *Flores* solitarii, terminales vel axillares. *Lobi calycis* 6–7 mm. longi, 1·5–2 mm. lati, lanceolati, acuminati, apice acuti, dense pubescentes; tubus 4 mm. longus, campanulatus. *Pedicellus* 4 mm. longus, teres, pubescens. *Vexillum* 1 cm. longum, 7 mm. latum, ovatum, apice acutum, glabrum; alae 8·5 mm. longae, 3 mm. latae, oblongae, apice truncatae; carina 8·5 mm. longa, 3 mm. lata, apice obtusa. *Filamenta* 7–8·5 mm. longa; antherae globosae vel lineares. *Ovarium* 4·5 mm. longum, oblongum, villosum; stylus 5 mm. longus, arcuatus; stigma globosum. *Fructus* 1·4 cm. longus, oblongo-linearis, turgidus, sericeo-pubescent.

Mountain slopes. 5–10 in. high, flowers yellow. Summer. *A. Dieterlen*, 268. Rare, flowers yellow, *Phillips*, 683.

SESUTO: *Mohlala*.

A dwarf plant with a deep underground cylindric tap root, over 20 cm. long and 1 cm. in diameter, with numerous slender branches arising from the upper end. *Branches* terete, pubescent. *Leaves* trifoliolate, stipulate, petiolate, 1–4 cm. long. *Stipules* solitary, 4–8 mm. long, 1·5–3 mm. broad, ovate, lanceolate or oblanceolate, subacuminate, acute, pubescent. *Median leaflet* 1·5–3·2 cm. long, ·7–1·2 cm. broad, mostly elliptic or lanceolate-elliptic, obtuse or subobtuse, mucronate, pubescent; lateral leaflets, 1–2 cm. long, 3–5 mm. broad, lanceolate, oblanceolate-elliptic or lanceolate-elliptic, acute or obtuse, pubescent.

*Flowers* solitary, terminal or axillary, yellow. *Calyx-lobes* 6–7 mm. long, 1·5–2 mm. broad, lanceolate, acuminate, acute, densely pubescent, almost villous; tube 4 mm. long, campanulate. *Pedicel* 4 mm. long, terete, pubescent. *Vexillum* 1 cm. long, 7 mm. broad, ovate, acute, glabrous, with a semiterete claw 3 mm. long; alae 8·5 mm. long, 3 mm. broad, oblong, truncate at the apex, with a narrow linear claw 3 mm. long; carina 8·5 mm. long, 3 mm. broad, almost plano-convex in outline, obtuse, with a claw 2·5 mm. long. *Stamens* monodelphous, with 6 filaments longer than the other 4; the longer filaments 8·5 mm. long with globose anthers; the shorter filaments 7 mm. long with linear anthers. *Ovary* 4·5 mm. long, oblong in outline, many-ovuled, villous; style 5 mm. long, arcuate; stigma globose. *Fruit* 1·4 cm. long, oblong-linear, turgid, silvery-pubescent.

Near *L. laxa*, E. & Z., from which it differs in having larger leaves and a differently shaped vexillum.

**L. Dieterlenii**, Phillips, sp. nov. (§ *Krebsia*). *Suffrutex* 20–35 poll. altus. *Rami* longi, graciles e caudice, dense pubescentes. *Folia* petiolata, trifoliolata. *Petiolus* 5 mm. longus, pubescens. *Foliola* 1·3–1·9 cm. longa, 1–3·5 mm. lata, lanceolata, apice acuta, mucronata, basi angustata, pubescentia. *Stipula* circiter 2 mm. longa, linearis. *Inflorescentia* laxa, pedunculata, racemosa vel spicata, axillaria. *Pedunculus* 2–7 cm. longus, dense pubescens, supra 1–4-florifer, infra nudus. *Bracteae* 2–5 mm. longae, 5–1 mm. latae, inaeles vel lanceolato-lineares, pubescentes. *Pedicellus* 1·5 mm. longus, teres, villosus. *Tubus calycis* 5·5 mm. longus, villosus; lobi 2 mm. longi, ovati, acuminati, apice acuti, villosi. *Vexillum* 9 mm. longum, ovatum, apice retusum, subtus pubescente; alae 1 cm. longae, 2 mm. latae; carina 1 cm. longa, 2 mm. lata, apice obtusa. *Ovarium* 4 mm. longum, villosum; stylus 6 mm. longus, arcuatus; stigma capitatum. *Fructus* junior 6 mm. longus, villosus.

Slopes of high mountains. 20–35 in. high, flowers mauve-grey. Malavangeng, Leribe District. Summer. *A. Dieterlen*, 871.

DISTRIBUTION: Endemic.

SESUTO: Mosita-tlali. See *Buchenroedera viminea*.

A shrub 20–35 in. high. *Branches* long, slender, densely pubescent. *Leaves* petiolate, 3-foliolate, petiole 5 mm. long, pubescent; leaflets 1·3–1·9 cm. long, 1–3·5 mm. broad, lanceolate, acute, mucronate, narrowed at the base, pubescent. *Stipules* solitary, about 2 mm. long, linear. *Flowers* in racemose or spicate long-peduncled axillary lax inflorescences. *Peduncles* 2–7 cm. long, densely pubescent, bearing 1–4 flowers on the terminal portion, naked below. *Bracts* 2–5 mm.

long, .5–1 mm. broad, linear or lanceolate-linear, pubescent. *Pedicel* 1.5 mm. long, terete, villous. *Calyx-tube* 5.5 mm. long, villous; lobes 2 mm. long, ovate, acuminate, acute, villous. *Vexillum* 9 mm. long, ovate, retuse, with a linear channelled claw 5 mm. long, pubescent without near the margin; alae 1 cm. long, 2 mm. broad, rounded above, with a linear claw 5 mm. long; carina 1 cm. long, 2 mm. broad, almost plano-convex in outline, obtuse. *Ovary* 4 mm. long, terete, villous, many-ovuled; style 6 mm. long, curved; stigma capitate. *Young fruit* 6 mm. long, semi-terete, villous, about 4-seeded.

Near *L. cytisoides*, Bth., *L. Wyliei*, Wood, and *L. Galpini*, Dümmer, from all of which it differs in having long peduncles which are up to 4-flowered.

***L. trisegmentata***, Phillips, sp. nov. (§ *Krebsia*) (Pl. III, fig. A). *Suffrutex*, .5–1.2 m. altus. *Rami* villosi. *Folia* stipulata, petiolata, trifoliata. *Stipulae* 1 vel 2, 3–4 mm. longae, .75 mm. latae, lineares, apice acutae, villosae. *Petiolus* 3–5 mm. longus, teres, dense pubescens. *Foliola* .5–1 cm. longa, 2–3 mm. lata, obovata, oblanceolata vel oblanceolato-linear, apice acuta, villosa. *Flores* solitarii, terminales vel axillares. *Pedicellus* 3.5 mm. longus, teres, dense pubescens. *Tubus calycis* 4 mm. longus, villosus; lobi 6 mm. longi, ovati, acuminati, apice obtusi, villosi; lobi laterales connati. *Vexillum* 1.2 cm. longum, 1 cm. latum, suborbiculatum, subtus dense villosum; alae 1.2 cm. longae, infra 4 mm. latae, ovato-lanceolatae, apice subobtusae, glabrae, infra rugosae; carina 1.4 cm. longa, 5 mm. lata, apice obtusa. *Ovarium* 1 cm. longum, lineare, dense villosum; stylus 7 mm. longus, arcuatus; stigma minutum, capitatum. *Fructus* 2.4 cm. longus, 3.5 mm. latus, compressus, rostratus, villosus.

Slopes near the Caledon River. Flowers bright yellow and blue.

Summer. *A. Dieterlen*, 353.

SESUTO: *Motoai-toai*. He who wanders alone. The Basutos give the plant this name because individuals do not usually grow together, but are scattered about.

An erect plant .5–1.2 m. high. *Branches* terete, villous. *Leaves* stipulate, petiolate, trifoliolate. *Stipules* 1 or 2, 3–4 mm. long, .75 mm. broad, linear, acute, villous. *Petiole* 3–5 mm. long, terete, densely pubescent. *Leaflets* .5–1 cm. long, 2–3 mm. broad, obovate, oblanceolate or oblanceolate-linear, acute, villous. *Flowers* solitary, terminal, or axillary. *Pedicel* 3.5 mm. long, terete, densely pubescent. *Calyx-tube* 4 mm. long, villous; lobes 6 mm. long, ovate, acuminate, obtuse, villous; the lateral lobes held in close contact with one another by the interwoven hairs so that the calyx appears to have only 3 segments.



*Vexillum* 1·2 cm. long, 1 cm. broad, suborbicular, densely villous without, with a short concave claw 3 mm. long bent at right angles to the limb; alae 1·2 cm. long, 4 mm. broad below, ovate-lanceolate, subobtusate, glabrous, with transverse ridges on the lower half and a linear claw 4 mm. long; carina 1·4 cm. long, 5 mm. broad, almost plano-convex in outline, obtuse, with a linear claw 4 mm. long. *Ovary* 1 cm. long, linear in outline, densely villous; style 7 mm. long, curved; stigma minute, capitate. *Fruit* 2·4 cm. long, 3·5 mm. broad, compressed, beaked, villous.

Closely allied to *L. Wyliei*, Wood, from which it differs in the less shrubby habit and in the manner in which the lateral calyx-lobes are joined.

#### **forma sericea.**

Ramuli, folia vexillumque sericeo-pubescentes non villosi.

In this form of the species the branchlets, leaves, and vexillum are silky-pubescent, not villous, as in the type.

Slopes of Litsoëneng Mountain, Botsàbelo, near Maseru. February. Flowers cream and blue. *A. Dieterlen*, 1020.

#### **var. robusta**, Phillips, var. nov.

A typo habitis robustioribus et ramis rigidis lignosis divaricatis differt.

This is distinguished from the type by the more robust habit, and by having stiff woody divaricate branches, otherwise similar to the type.

Slopes of the Mont-aux-Sources, 8000 ft., January, *Flanagan*, 2095.

#### **forma sericea.**

Folia sericeo-pubescentia non dense pubescentia.

Similar to var. *robusta*, but the leaves are finely silky-pubescent, not densely pubescent.

Natal, Drakensberg, Polela, 6–7000 ft., February. Flowers light-blue, *Evans*, 634.

The above separation of the species must be regarded as provisional until more material can be examined. The material at my disposal certainly showed four distinct forms, which could be easily separated by a superficial examination. *Evans* 634 and *Flanagan* 2095 differ from both of Madame Dieterlen's specimens by their more robust habit. The branches are from 4–5 mm. in diameter, whereas in the Basutoland specimens they are only 2 mm. in diameter. Then again *Evans* 634 and *Dieterlen* 1020 agree in having a silky indumentum, while *Flanagan* 2095 and *Dieterlen* 353 have a densely pubescent,



almost villous indumentum. I could find no characters by which the specimens could be suitably separated except for the more robust habit of *Evans* 634 and *Flanagan* 2095, and as this gives them such a distinct appearance from the Basutoland specimens I have thought it advisable to include them in a var. *robusta*, and to look upon *Evans* 634 as a silky form of the variety in the same way as *Dieterlen* 1020 is a silky form of the type.

### ASPALATHUS, Linn.

#### A. poliotes, E. & Z.

Klein Pot River Drift, 4550 ft., March, *Galpin*, 6603.

DISTRIBUTION: Swellendam. Albany. Uitenhage.

Dr. Bolus identified Mr. Galpin's plant as *A. frankenioides*, DC. The above name was given by Kew.

### BUCHENROEDERA, E. & Z.

#### B. viminea, Presl.

Mountain slopes and plateau. 10-30 in. high, flowers mauve. Summer. *A. Dieterlen*, 611!

DISTRIBUTION: Pondoland. East Griqualand. Natal.

SESUTO: *Mosita-tlali*. He who overcomes lightning. Mixed with *Dichilus strictus*, E. Mey., it is used as a charm against lightning.

#### B. glabriflora, N. E. Br.

Stony places on slopes of the Mont-aux-Sources, 8850 ft., January, *Thode*, 7!

DISTRIBUTION: Queenstown.

#### B. lotononoides, Scott-Elliot.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8142!; Van Reenen, 6000 ft., February, *Wood*, 5625.

#### B. sparsiflora, Wood & Evans.

Bushman's River Pass, 8-9000 ft., April, *Evans*, 716.

DISTRIBUTION: Endemic.

### MELOLOBIUM, E. & Z.

#### M. microphyllum, E. & Z.

Ravines and mountain slopes. 2-4 ft. high, flowers yellow. *A. Dieterlen*, 163!; Qoqolosi Peak, flowers yellow, *Phillips*, 956!; near Caledon River and Orange River, *Zeyher*, 391!

DISTRIBUTION: Graaff Reinet. Komgha.

SESUTO: *Sehlabane*. He who pricks. *Mofahla-toeba*. He who offends the mouse. The plant is placed under the big grain baskets and the thorns keep mice away. Bushes are burnt in a sick room and the smoke acts as a fumigator.

var. *decumbens*.

Grassy slopes of "Matelas Peak," c. 7200 ft., January, *Thode*, 11!; Bushman's River Valley, 6-8000 ft., October, *Wylie in Herb. Wood*, 10656.

DISTRIBUTION: Endemic.

*M. alpinum*, Linn.

Mountain slopes. 8-30 in. high, flowers yellow. Summer. *A. Dieterlen*, 552!; Bester's Vlei, near Witzie's Hoek, 6000 ft., December, *Planagan*, 1937!

DISTRIBUTION: Queenstown. Molteno. East Griqualand. Natal.

SESUTO: '*Musa pelo o moholo*. The big "Musapelo." *Motsöchla*. He who oozes. Derived from "ho busa"—to bring back, and "pelo"—the heart. Should be "Mo-busa-pelo"—he who brings back the heart or courage. This name is given to many Leguminosae, which are largely used by witch-doctors and others in Basutoland as a sedative for comforting persons who have passed through great sorrow (*e. g.* a mother at the death of her child), or who are depressed and sad. The medicine is supposed to make the person forget his sorrow and to encourage him to be happy again. It is administered to all heathen Basutos after the death of a near relative.

*M. obcordatum*, Harv.

Mountain slopes. 6-25 in. high, flowers yellow. Spring. *Dieterlen*, 558!; Qoqolosi Peak, flowers yellow, *Phillips*, 967!; near Buffalo River Waterfall, 7500 ft., March, *Galpin*, 6604

DISTRIBUTION: Natal.

SESUTO: *Linavana tsa thaba*. The small beans of the mountain.

*M. Pegleri*, Dümmer.

Grassy hills between Matela and the Caledon River, c. 6150 ft., January, plant clammy, flowers yellow, *Thode*, 9!

DISTRIBUTION: Endemic.

## DICHILUS, DC.

*D. strictus*, E. Mey.

Ravines and mountain slopes. Flowers yellow. Summer. *A. Dieterlen*, 379!; Eland's River, at the foot of the Mout-aux-Sources, 5600 ft.,

December, *Flanagan*, 1941!; Brakwaal, foot of Drakensburg, 5000 ft., November, *Wood*, 6604.

DISTRIBUTION: Natal.

SESUTO: *Lesita-tlali*. He who overcomes lightning. This plant and *Buchenroedera viminea* are burnt and the ashes mixed with water, everything and everybody in the village is then sprinkled with the mixture and are then supposed to be immune to lightning. The brush used for the sprinkling is called a "lechoba," and is made from the long hairs at the end of an ox's tail. If the tail of a brindled gnu is used the charm is believed to be more effective.

var.

Banks of streamlets in the Caledon Range (spur of Drakensbergen), Conquered Territory, c. 6150 ft., January, flowers yellow, *Thode*, 8!

DISTRIBUTION: Endemic.

## CROTALARIA, *Linn.*

*C. distans*, Benth.

Veld and mountain slopes. 6-20 in. high, flowers yellow. Summer.

*A. Dieterlen*, 495!

DISTRIBUTION: Natal. Bechuanaland.

SESUTO: *Moōkana*. Meaning unknown. *Thotsana*. A small seed. *Musa pelo a mosehlanyana*. The yellowish comforter. Together with *Erythrina Zeyheri*, Harv., it is used to make a "thato" or charm which enters certain medicines.

## CYTISUS, *Linn.*

*C. natalensis*, Bolus.

Natal. Bushman's River Pass, c. 6300 ft., November, *A. Bolus*, in *Herb. Bolus*, 10456!

DISTRIBUTION: Endemic.

## ARGYROLOBIUM, *E. & Z.*

*A. longifolium*, Walp.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8146!

DISTRIBUTION: Natal. Transvaal (Elandspruitberg).

*A. tuberosum*, E. & Z.

Mountain slopes. 6-14 in. high, flowers brown and yellow. Summer. *A. Dieterlen*, 590!; Ravine on west slopes of Leribe plateau, alae and carina yellow, vexillum brown, *Phillips*, 669!; Bester's Vlei, near

Witzie's Hoek, 5500 ft., December, *Flanagan*, 1930!; Drakensberg, 5000 ft., January, *Wood*.

DISTRIBUTION: Knysna. Albany. Transvaal (Magaliesberg).

SESUTO: *Lebesana*. Little milk. *Tsoetlae nyenyane*. Little "Tsoetla." *Lethölömache*. Meaning unknown. Children chew the roots.

**A. collinum**, E. & Z.

Mountain slopes, 8–16 in. high, flowers yellow. Spring. *A. Dieterlen*, 652!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8147!

DISTRIBUTION: Caledon. Riversdale. Uitenhage. Albany. Graaff Reinet. Cradock. Rhodesia.

SESUTO: '*Musa pelo oa matlapa*. The comforter of the flat stones.

**A. Andrewseanium**, Steud. var. **pauciflorum**.

Mahwahqa, 6–7000 ft., March, *Wood*, 8256.

DISTRIBUTION: Transvaal (Barberton).

**A. amplexicaule**, Dümmer.

Natal, Giant's Castle, c. 6000 ft., November, *A. Bolus in Herb Bolus*, 6878!

DISTRIBUTION: Transkei. East Griqualand.

**A. nanum**, Schltr.

Veld and road sides. 2–4 in. high. April. Botsabelo, near Maseru, *A. Dieterlen*, 1023!; Van Reenen, 4500 ft., December, *Wood*, 5875!

DISTRIBUTION: Endemic.

SESUTO: *Mohlala*.

**A. nigrescens**, Dümmer.

Basutoland, without precise locality, *Cooper*, 2179; Harrismith, *Sankey*, 56; Natal, Van Reenen Pass, c. 6500–8400 ft., *Wood*, 4517.

DISTRIBUTION: Endemic.

**A. Sankeyi**, Dümmer (*ex descr.*).

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1876!; Harrismith, *Sankey*, 43; Giants Castle, 7000 ft., November, *A. Bolus in Herb. Guthrie*, 4800

DISTRIBUTION: East Griqualand.

**A. variopile**, N. E. Br.

Veld and mountain slopes. 4–12 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 520!; Drakensberg, 5–6000 ft., December, *Wood*, 5693, 6355.

DISTRIBUTION: Endemic.

**SESUTO:** *Moomang o monyenyane*. The small "Moomang." *Musa pelo o monyenyane*. The small comforter. See *Melolobium alpinum*.

On this sheet was mounted a specimen (fruiting) belonging to a different species, which owing to lack of material I was unable to determine.

**A. cf. A. tuberosum**, E. & Z.

Mountain slopes, 4-8 in. high, flowers yellow. Summer. *A. Dieterlen*, 521!; Lefi's Kloof, N.E. slopes of Leribe plateau, flowers yellow. *Phillips*, 825!

**SESUTO:** *Malimantsoetlana*. Meaning unknown. The native children sometimes chew the roots.

This is probably *A. tuberosum*, E. & Z., but the material is poor. The plant has a long tuberous root sometimes exceeding 1 ft. in length.

**A. sp.** (cf. *A. pumilum* E. & Z.).

Tsitsa Footpath, Ben Mc Dhui and Satsanna Berg, 7900-9750 ft., March. *Galpin*, 6606, 6607.

**A. sp.** (*deflorate*).

Summit Ben McDhui, 9900 ft., March, *Galpin*, 6605.

## MEDICAGO, Linn.

**M. laciniata**, All.

Veld and mountain slopes. 6-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 147!

**DISTRIBUTION:** Cape. Swellendam. Uitenhage. Albany. Graaff Reinet. Griqualand West.

**SESUTO:** *Bohōmenyana*. The small "Bohome." Derived from the verb "ho homa"—to adhere or stick to, referring to the spiny fruits which adhere to the clothes. The plant is well ground and as an infusion is used as a love philtre.

## TRIFOLIUM, Linn.

**T. africanum**, Ser. var. *glabellum*, Harv.

Veld, river banks and mountain slopes. A creeping plant, 6-30 in. long. Summer-Autumn. *A. Dieterlen*, 94!; In stream on Leribe plateau, flowers red, *Phillips*, 803!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8148!; Marsh at base of Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6608!; near Buffalo River Waterfall, 8200 ft., March, *Galpin*, 6609!

**DISTRIBUTION:** Tembuland. East Griqualand.



SESUTO: *Mōqōpōlla thula*. Meaning unknown. It is often mentioned in the Basuto folklore as being eaten by women. *Mokopshoe*. Meaning unknown. *Moqophi*. He who goes deep (referring to the root). *Palesa e bitsoa morokō*. The flower is called "Moroko." As an infusion or chewed raw it is used as a remedy for sore throat or heart pains. The inflorescence is eaten by children.

I cannot agree with Harvey in separating *T. Burchellianum*, Ser. and *T. africanum*, Ser., as the two species appear to be united by his var. *glabellum*. In Madame Dieterlen's specimens, which show seven inflorescences, the calyces are wholly glabrous and the peduncles of four "heads" are quite devoid of hairs. The leaves are typical of *T. africanum*, Ser., and perfectly glabrous. The totally glabrous plant shows a variation in the direction of *T. Burchellianum* which would unite this species and *T. africanum* more closely than Harvey's var. *glabellum*. Galpin, 6608, 6609, are named in his list *T. Burchellianum*, Ser.

#### **T. angustifolium**, Linn.

Damp spots near fountain, Botha-Botha, Leribe District, flowers greyish-mauve. *A. Dieterlen*, 931!

DISTRIBUTION: Cape.

SESUTO: *Joang ba mehlaka*. The grass of the marshes. *Setlama qoapi*. A plant resembling an ear of corn.

### PSORALEA, Linn.

#### **P. polysticta**, Benth.

Ravines and mountain slopes. 30-40 in. high, flowers mauve. Summer. *A. Dieterlen*, 372!

DISTRIBUTION: East Griqualand. Natal. Swaziland. Bechuana-land.

SESUTO: *Mohlonecha*. He who makes respectable. A chief who wishes to have prestige in the sight of his subjects must bathe the whole of his body with a decoction of this plant. The burnt root is smoked as a cure for colds in the head.

### INDIGOFERA, Linn.

#### **I. spinescens**, E. Mey.

Mountain slopes, Berea, Maseru District. 2-3 ft. high, flowers carmine. Early spring. *A. Dieterlen*, 575!; Basutoland, without precise locality, *Cooper*, 694!

DISTRIBUTION: Queenstown. Aliwal North. Orange Free State.

SESUTO: *Lehlahla-Barvana*. Bush of the small Bushmen. The Bushmen, naturally short, could hide themselves behind these bushes when pursued by the Basutos. For colic, a decoction is prepared from it.

**I. dimidiata**, Vog.

Mountain slopes. 10-20 in. high, flowers red. Summer-Autumn. *A. Dieterlen*, 539!

DISTRIBUTION: Philipstown. Komgha. East Griqualand. Natal.

SESUTO: '*Musa pelo oa thaba*. He who brings back the heart of the mountain. See also *Melolobium alpinum*, Linn.

**I. cuneifolia**, E. & Z.

Natal, Bushman's River Valley, 7-8000 ft., October, flowers deep rose pink, *Wood*, 10567; Cathkin Peak, 10,000 ft., November, *A. Bolus in Herb. Guthrie*, 4804!

DISTRIBUTION: Albany. Philipstown. Somerset East. Queens-town. Stutterheim.

**I. tristis**, E. Mey.

Veld and mountain slopes. 20-25 in. high, flowers red. Summer-Autumn. *A. Dieterlen*, 441!

DISTRIBUTION: Komgha. East Griqualand. Natal.

SESUTO: '*Musa pelo*. See *Melolobium alpinum*, Linn.

**I. fastigiata**, E. Mey.

Mountain slopes and river banks. 10-20 in. high, flowers red. Summer. *A. Dieterlen*, 35!

DISTRIBUTION: Komgha. East Griqualand. Natal. Transvaal (Barberton).

SESUTO: *Phèhlèloane*. Derived from the verb "ho fèhla"—to churn. *Leta-la-phofu*. The saliva of the eland. Crushed and mixed with other plants it is used as a charm to give prestige to a chief. The burnt roots, which are smoked, are said to be a cure for headache.

**I. Zeyheri**, Spreng.

Veld and mountain slopes. 10-26 in. high, flowers white or red. Summer-Autumn. *A. Dieterlen*, 30! 30b!; flowers pink, occasional, *Phillips*, 667!

DISTRIBUTION: Uitenhage. Port Elizabeth. Alexandria. Albany. Somerset East. King William's Town. Natal (near Charlestown, 5-6000 ft.).

SESUTO: '*Musa pelo o monyenyane*. The small comforter.

**I. hedyantha**, E. & Z.

Near rocks on mountain slopes. 10–30 in. high, flowers bright red. Summer. *A. Dieterlen*, 630!; near “Cave” at foot of the Mont-aux-Sources, 6800 ft., January, *Flanagan*, 1940!

DISTRIBUTION: Philipstown. Komgha. Tembuland. East Griqualand.

SESUTO: '*Musa pelo oa mofika*. 'The comforter of the rocks. See also *Melolobium alpinum*, Linn.

**I. hilaris**, E. & Z.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8151!; Van Reenen, 5–6000 ft., December, *Wood*, 6240!

DISTRIBUTION: Albany. Komgha. East Griqualand. Natal. Transvaal (Pretoria.)

**I. Evansii**, Schltr.

Drakensberg, 6–7000 ft., February, *Evans*, 636.

DISTRIBUTION: Endemic.

**I. rostrata**, Bolus.

Bester's Vlei, near Witzie's Hoek, 5400 ft., *Bolus*, 8150!; Van Reenen, 5500 ft., December, *Wood*!

DISTRIBUTION: Pondoland.

**I. sp.**

Natal, slopes of Drakensbergen, 5000 ft., *Wood*, 3510!

**I. sp.**

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8149!

## TEPHROSIA, Pers.

**T. polystachya**, E. Mey.

Bester's Vlei, near Witzie's Hoek, c. 6000 ft., *Thode*!

DISTRIBUTION: Komgha. Tembuland. East Griqualand. Natal.

**T. capensis**, Pers.

Mountain slopes and plateau. Branches trailing on the ground, 6–25 in. long, flowers bright carmine. Summer–Autumn. *A. Dieterlen*, 129! 333!; mountain slopes behind the Mission Station, a straggling plant or a scrambler, flowers dark red, *Phillips*, 522! 528!

DISTRIBUTION: Cape. Swellendam. Knysna. George. Port Elizabeth. Uitenhage. Albany. Komgha. East Griqualand. Transvaal.

SESUTO: *Pelo li marōba*. The hearts have holes (or are pierced). The name given in reference to the roots being eaten by worms in summer. The cooked roots are given in cases of palpitation of the heart.

On examining many specimens of this species I am unable to satisfactorily divide them into the varieties proposed by Harvey and so have not adopted them, though the specimen No. 333 would be included in his var. *angustifolia*, and No. 129, which has larger leaves, perhaps in var. *hirsuta*.

**T. sp.**

Veld and mountain slope. 8–20 in. high, flowers carmine. Spring-summer. *A. Dieterlen*, 175!

SESUTO: *Tsoetla*. *Tsoetsoetlela*. *Malintsoetla*. *Malsoetintsoetla*. Meanings unknown. Native children are fond of the roots of this plant and go long distances to find them. The shepherd boys say that it relieves thirst. The fibre is used to make ropes. As a charm for children, the ground roots are put in incisions made on the body.

SUTHERLANDIA, Br.

**S. frutescens**, R. Br.

Mountain slopes and banks of rivers. 3–6 ft. high, flowers bright red. Spring. Letlapeng, Leribe District, *A. Dieterlen*, 643!

DISTRIBUTION: Van Rhynsdorp. Clanwilliam. Tulbagh. Cape. Swellendam. Molteno. Transvaal.

SESUTO: '*Musa-pelo oa nōku*. The comforter of the river. Used as an infusion for dropsy of the heart.

LESSERTIA, DC.

**L. perennans**, DC.

Damp spots on the mountain slopes. 18–30 in. high, flowers mauve, Summer–Autumn. *A. Dieterlen*, 360!; slopes of ravine on the west slopes of Leribe plateau, 1–2 ft. high, flowers pink, *Phillips*, 587!

DISTRIBUTION: Somerset East. Komgha. East Griqualand. Natal.

SESUTO: '*Musa-pelo o moholo oa liliba*. The great comforter of the springs. See *Melolobium alpinum*, Linn.

**L. polystachya**, Harv.

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1882!

DISTRIBUTION: Natal. Transvaal (Magaliesberg).

Flanagan's plant is not so hoary as the type (*Zeyher*, 460) and the

Pods are longer (up to 8 in. long), but otherwise I can find no specific differences.

**L. depressa**, Harv.

Mahobane, Leribe District, flowers pink and purple, November, *A. Dieterlen*, 1008!

DISTRIBUTION: Graaff Reinet.

SESUTO: '*Musa pelo*.

**L. Thodei**, L. Bolus.

Summit of the Mont-aux-Sources, 9800 ft., January, *Flanagan*, 1939!; grassy and stony places at the summit of the Mont-aux-Sources, c. 8850 ft., January, *Thode*, 12!

DISTRIBUTION: Endemic.

**L. stricta**, Bolus.

Veld and mountain slopes. 20–35 in. high, flowers carmine pink. Summer. *A. Dieterlen*, 95!; Natal, Van Reenen, 5–6000 ft., flowers deep pink, *Wood*, 8846! 10727!

DISTRIBUTION: East Griqualand. Transvaal (Scheerpoort, Amerspoort, Crocodile River).

SESUTO: '*Musa pelo o mohola*. The big comforter. As a decoction, preparation made from this plant is drunk every day by a person who has passed through some affliction until he is better.

**L. Dykei**, L. Bolus.

Mont-aux-Sources, 8000 ft., October–December, *Flanagan in Herb. Bolus*, 8152!, *E. Dyke in Herb. Marloth*!

DISTRIBUTION: Endemic.

## ERYTHRINA, *Linn.*

**E. Zeyheri**, Harv.

Veld. 15–30 in. high, flowers bright red. Summer. *A. Dieterlen*, 547!

DISTRIBUTION: Orange Free State (between Senekal and Bethelém). Transvaal (Magaliesberg).

SESUTO: *Mofumo*. Derived from the verb "ho fuma"—to take the fibres from a plant. The "fibre" of this plant is not easily stripped off. They are used to relieve people suffering with asthma. The red seeds are called "Khumoana" and used as beads to make necklaces.



PHASEOLUS, *Linn.*

**P. Mungo**, *Linn.*

A cultivated plant, flowers mauve. *A. Dieterlen*, 693!

DISTRIBUTION: A native of India, said to have been introduced into Basutoland from Natal primarily as a medicine, now cultivated for food.

SESUTO: *Lehlōli*. He who observes from above. The seeds are ground and rubbed into a scarified tumour or abscess to promote the formation of pus.

VIGNA, *Savi.*

**V. sp.**

Natal, Van Reenen, 6500 ft., March, *Schlechter*, 6784!

DOLICHOS, *Linn.*

**D. chloryllis**, *Harv.*

Veld and mountain slopes. A creeping plant, 3-5 ft. long, flowers green, crimson, and yellowish. December-January. *A. Dieterlen*, 833!; banks of Caledon River, *Burke*!

DISTRIBUTION: Endemic.

SESUTO: *Letōmōkō*. Derived from the verb "ho tōmōkela," to make a noise (by an assembly of people) with the mouth. This plant is much used by the witch-doctors when working the divining bones. Used as a charm to drive away an approaching hailstorm.

RHYNCHOSIA, *Lour.*

**R. hirsuta**, *E. & Z.*

Veld and mountain slopes. A creeping plant 15-40 in. long, flowers brownish-yellow. Summer. *A. Dieterlen*, 92!

DISTRIBUTION: Albany. Philipstown. Stockenstroom. Komgha. East Griqualand. Transvaal (Magaliesberg).

SESUTO: *Monyatalane*. He who passes unripe grain. The roots are chewed.

**R. adenodes**, *E. & Z.*

Veld and mountain slopes. Trailing plant, 10-30 in. long, flowers yellow. Summer-Autumn. *A. Dieterlen*, 112!; Leribe plateau, flowers, yellow, occasional, *Phillips*, 674!; Thaba Unchu, *Zeyher*, 280!

DISTRIBUTION: Komgha. East Griqualand. Natal. Orange Free State (Orange River).

SESUTO: *Monyamali*. He who passes blood (so called on account

of the red sap). The roots and stems are crushed and given to calves, and cattle in milk as a cure for dysentery.

**R. Totta**, DC.

Veld and mountain slopes. 6–15 in. high, flowers yellow. Summer. *A. Dieterlen*, 66! Leribe plateau, flowers yellow, *Phillips*, 698!; Caledon River, *Zeyher*!

DISTRIBUTION: Port Elizabeth. Albany. Queenstown. Philips-town. Komgha. Transvaal (Magaliesberg, Zeerust, Crocodile River).

SESUTO: *Seoelioetla* and *Sebelibetloa*. Meaning unknown. *Seltōli*. He who jumps over. Children eat the roots.

**R. craibaea**, DC.

Mountain slopes. A creeping plant, 2–4 ft. long, flowers yellow. February–March, Matalane slopes, Leribe District. *A. Dieterlen*, 840!

DISTRIBUTION: East Griqualand. Natal.

SESUTO: *Monyamali*. He who passes blood. *Morarana oa liphèpa*. The creeper of the white clay. A lotion for rheumatic pains is made from the cooked roots. The dried and powdered roots, taken as a snuff, is supposed to be a cure for headache. Formerly a decoction of this plant was used to wash garments made from the skins of sheep and goats.

**R. Woodii**, Schinz.

Hill-side, Van Reenen, November, *Wood*, 6627.

DISTRIBUTION: Endemic.

**R. Harmsiana**, Schltr.

Bester's Vlei, near Witzie's Hoek and Bethlehem, 5300 ft., January, *Bolus*, 8154!

DISTRIBUTION: Transkei.

**R. sp.**

Oliver's Hoek Pass, 5–6000 ft., January, *Wood*, 3532.

ERIOSEMA, DC.

**E. cordatum**, E. Mey.

Mountain slopes. 6–18 in. high, flowers yellow and brown. Summer. *A. Dieterlen*, 221!; Lefi's Kloof, N.E. slopes of Leribe plateau, *Phillips*, 830!

DISTRIBUTION: East Griqualand. Natal. Transvaal.

**SESUTO:** *Leshetla*. Soft bone. *Lesapo le lets'hali*. The female bone. *Setlōli se schola*. The big jumper. Used as a stimulant for bulls in spring, but not so powerful as *E. salignum*, E. Mey., and must be mixed with other plants.

**E. salignum**, E. Mey.

Veld and mountain slopes. 10–20 in. high, flowers yellow. Summer. *A. Dieterlen*, 104!; Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*, 8155!

**DISTRIBUTION:** Albany. Tembuland. East Griqualand. Natal. Transvaal (Barberton).

**SESUTO:** *Lesapo*. Bone. So called because the long root is as hard as bone. Used as a stimulant for bulls in spring.

**E. parviflorum**, E. Mey. (*ex descr.*).

High mountain slopes. 15–25 in. high, flowers yellow. Summer. Malaoaneng, Leribe District, *A. Dieterlen*, 866!

**SESUTO:** *Leshetla la lōti*. The “Leshetla” of the high mountain.

**DISTRIBUTION:** Natal.

**E. sp.**

Van Reenen, 5–6000 ft., December, *Wood in Govt. Herbarium*, 7627.

**CALPURNIA**, E. Mey.

**C. robinoides**, E. Mey. (= *C. sericea*, Harv.).

Ravines and mountain slopes. A tree, flowers bright yellow. Spring–Summer. Tsikvane, Leribe District, *A. Dieterlen*, 584!; Basutoland, *von Schlicht*, 82; Kraai River, Aliwal North, *Drège*.

**DISTRIBUTION:** Endemic.

**SESUTO:** *Motsöhlo*. Derived from the verb “ho tsöhla,” to chew or masticate. So called because the branches do not break “clean,” but tear. Used as firewood and for building huts.

**C. intrusa**, E. Mey.

Mountain slopes. Flowers yellow. Summer–Autumn. *A. Dieterlen*, 37! Lefi's Kloof, N.E. slopes of Leribe plateau, a large bush 5–6 ft. high, occasional, *Phillips*, 835!; Bester's Vlei near Witzie's Hoek, 5400–5500 ft., December, *Bolus*, 8156! *Flanagan*, 1877!; Natal, Currie's Post, 5000 ft., *Schlechter*, 6811!

**DISTRIBUTION:** Komgha. Tembuland. East Griqualand. Natal.

**SESUTO:** *Tloèlè*. *Tloèlè*. Meanings unknown. The plant is crushed and mixed with water, and the mixture is sprinkled over skins (of freshly killed animals) which have been pegged to the ground to dry.

The mixture being bitter, dogs or pigs will not mutilate the skins. A lotion is also prepared from it to wash bad maggoty wounds of animals.

**C. Woodii**, Schinz.

Slopes of Drakensbergen, 4-5000 ft., January, *Wood*, 3516!

DISTRIBUTION: Endemic.

HOFFMANSEGGIA, *Cav.*

**H. Sandersoni**, Wood.

Natal. Tabanhlope, 6000 ft., *Wood*, 10483!

DISTRIBUTION: Endemic.

ELEPHANTORHIZA, *Benth.*

**E. Burchellii**, Benth.

Veld and mountain slopes. 10-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 46!; Caledon River, *Burke*; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8157!

DISTRIBUTION: S.W. Africa. Queenstown. Komgha. Natal. Orange Free State (between Senekal and Bethalem). Transvaal (near Pretoria).

SESUTO: *Mositsane*. Meaning unknown. The crushed roots, mixed with water, are used to make skins supple and impart a reddish colour to them. The roasted seeds are a substitute for coffee. The Dutch name is "Elandsbontjes." See Kew Bulletin, 1907.

ACACIA, *Willd.*

**A. horrida**, Willd.

Veld and mountain slopes. A tree, flowers yellow. Berea, *A. Dieterlen*, 185!

DISTRIBUTION: Uitenhage. Komgha.

SESUTO: *Leōka*. Derived from the verb "ho okamela"—to hang over and make shade. The crushed roots are mixed with the food of infants as a cure for colic. Believed to have been introduced into Basutoland.

ROSACEAE.

RUBUS, *Linn.*

**R. Ludwigii**, E. & Z.

Mountain slopes, near rocks. Bush 3-5ft. high, flowers carmine. Spring-Summer. *A. Dieterlen*, 19!

DISTRIBUTION: Molteno. Queenstown. East Griqualand. Natal.

SESUTO : *Monokotsoai oa basali*. The mulberry or raspberry of the women. See also *R. rigidus*, Sm.

**R. rigidus**, Sm.

Mountain slopes, near rocks. 3-5 ft. high, flowers carmine. Spring-Summer. *A. Dieterlen*, 20!

DISTRIBUTION : Tulbagh. Caledon. Worcester. Swellendam. Knysna. Uitenhage. Port Elizabeth. Komgha. Natal. Transvaal.

SESUTO : *Monokotsoai oa banna*. The mulberry or raspberry of the men. The fruits are edible. A decoction is made from the roots and given when there is acute pain in any illness. The natives believe that the prickly nature of the plant will struggle with the pain and so overcome it.

GEUM, *Linn.*

**G. capense**, Thunb.

Slopes of high mountains. 3-15 in. high, flowers yellow. Summer. Malavaneng, Leribe district, *A. Dieterlen*, 870!; Drakensbergen, Schonghong, *A. Dieterlen*, 736!; summit Mont-aux-Sources, 9500 ft. January, *Flanagan*, 2123!

DISTRIBUTION : Albany. King William's Town.

SESUTO : *Qoyoana ea Lesōtho*. The small "Qobo" of Basutoland. "Qobo" is *Gunnera perpensa*, which resembles this plant in the shape of the leaves. *Hlapi ea lōti*. The fish of the high mountain. No. 736 appears to be a dwarf form only 3-8 in. high.

**G. sp.**

Mountain slopes. Flowers yellow. Summer. *A. Dieterlen*, 899!

SESUTO : *Hlapi ea lōti*. The fish of the high mountain.

Material too poor for determination, but I suspect it to be only *G. capense*, Thunb.

ALCHEMILLA, *Linn.*

**A. Woodii**, O. Kuntze.

Damp spots on veldt and mountain slopes. A prostrate plant, 3-12 in. long, flowers pale yellow. Summer. *A. Dieterlen*, 307!; Leribe plateau, flowers yellow, *Phillips*, 700!; stony roadside on the Caledon River and Conquered Territory, c. 6000 ft., January, *Thode*, 13!; Bester's Vlei, near Witzie's Hoek, 6200-6700 ft., December, *Flanagan*, 1894! *Bolus*, 8158!; Natal, on a stony hill at Van Reenen, December, *Wood*, 4518.

DISTRIBUTION : Endemic.

SESUTO : *Mo-lala phōka*. He on whom the dew remains. *Morothetsa*. He who lets (dew) drop little by little. The plant is roasted on hot ashes and the smoke is supposed to relieve headache.



## LEUCOSIDEA, E. &amp; Z.

**L. sericea**, E. & Z.

Ravines and mountain slopes. Tree 8–10 ft. high, flowers yellow. Spring. *A. Dieterlen*, 164!; Natal up to 6000 ft.; ravine between Jonathan's village and the Mission Station, tree 12–15 ft., the principal tree in the ravine, *Phillips*, 586!

DISTRIBUTION: Tembuland. East Griqualand.

SESUTO: *Mosino*. Meaning unknown. *Theshe* or *Cheche*. These are Zulu names and the tree is better known by them than the old Sesuto name of "Mosino." Mixed with other plants it is used as a vermifuge. Largely used as firewood.

## AGRIMONIA, Linn.

**A. Eupatoria**, Linn.

Damp spots on mountain slopes. 1–3½ ft. high, flowers yellow. Summer. Boriberg, Leribe district, *A. Dieterlen*, 517!

DISTRIBUTION: Knysna. King William's Town. Komgha. Tembuland.

SESUTO: *Mosinvana*. The little "Mosino" (*Leucosidea sericea*, E. & Z.). Mixed with other plants it is used as a vermifuge.

## CLIFFORTIA, Linn.

**C. linearifolia**, E. & Z.

Bester's Vlei, near Witzie's Hoek, 6500 ft., December, *Bolus*, 8159!

DISTRIBUTION: Uitenhage. Natal.

**C. juniperina**, Linn.

Basutoland, without precise locality, *Cooper*, 690!

DISTRIBUTION: Van Rhynsdorp. Tulbagh. Cape. Paarl. Swellendam, Knysna.

**C. ramosissima**, Schltr.

Mountain slopes. Bush 2–4 ft. high, flowers yellowish. Autumn. *A. Dieterlen*, 71!

DISTRIBUTION: Caledon.

SESUTO: *Schalahala sa matlapa*. The bushy plant of the flat stones. Used as firewood.

**C. sp.**

Ravines and mountain slopes. Shrub 5–7 ft. high, flowers yellowish. Spring. *A. Dieterlen*, 288!; Van Reenen, *Schlechter*, 6748!

SESUTO: *Lenyofane*. Meaning unknown. Used as firewood.

This is a fruiting female specimen. I have compared it with a specimen collected by Schlechter (No. 6748) at Van Reenen, from which it only differs by the young branchlets being glabrous. Probably an undescribed species, but the material is too insufficient to describe.

**C. sp.**

Natal. Tabanblope, 6-7000 ft., June, *Evans*, 663.

DISTRIBUTION: Endemic?

SAXIFRAGACEAE.

VAHLIA, *Thunb.*

**V. capensis**, *Thunb.*

River banks, Metlotloaneng, Leribe district, flowers yellow, February, *A. Dieterlen*, 821!

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Malmesbury. Worcester. Paarl. Griqualand West. Transvaal.

SESUTO: *Phakisanyana*. Make little haste.

CRASSULACEAE.

CRASSULA, *Linn.*

**C. sarcocaulis**, *E. & Z.*

Stony banks of a streamlet, Amaqua Mtn., Witzie's Hoek, c. 6300 ft., February, a shrubby plant with white flowers, *Thode*, 14! summit of the Drakensbergen, near the source of the Tina River, 8750 ft., March, *Galpin*, 6614; Wittebergen, 5000 ft., *Drège*.

DISTRIBUTION: Queenstown. Murraysburg.

**C. rubicunda**, *E. Mey.*

Mountain slopes. 8-20 in. high, flowers dark red. Summer-Autumn. *A. Dieterlen*, 239!; ravine on west slopes of Leribe plateau, flowers dark red, occasional, *Phillips*, 617!

DISTRIBUTION: Natal. Swaziland.

SESUTO: *Khato*. Coloured spots (made by a native doctor on a patient). *Feko*. Name of a charm supposed to make a person unobserved.

**C. brachypetala**, *E. Mey.*

Bester's Vlei, near Witzie's Hoek, 5800 ft., December, *Bolus*!

DISTRIBUTION: Tembuland. Natal.

**C. platyphylla**, *Harv.*

Mountain slopes, 8-20 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 418 b!

DISTRIBUTION: Orange Free State (Bloemfontein).

SESUTO: See *C. Turrita*, Thunb.

**C. rubescens**, Schönl & Bkr. f.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1834!; Doodman's Krans Mtn., 9650 ft., March, *Galpin*, 6625.

DISTRIBUTION: Endemic.

**C. sediflora**, E. & Z.

Leribe, *A. Dieterlen*, 252a! *ex parte*; growing on sloping rocks at side of streams, flowers white, *Phillips*, 739!; south slopes of Leribe plateau above Khaniane, *Phillips*, 885!

DISTRIBUTION: Cathcart. Stockenström.

SESUTO: See *C. basutica*, Schönl.

**C. tenuicaulis**, Schönl.

Natal, Van Reenen, 5500 ft., March, *Schlechter*, 6964.

DISTRIBUTION: Endemic.

**C. umbraticola**, N. E. Br.

Natal, in moist places under dense shade, Van Reenen, 5-6000 ft., *Wood*, 5961, 5969; *Evans*, 362.

DISTRIBUTION: Endemic.

See note under *C. crenatifolia*, Bkr. f.

**C. natans**, Thunb.

In a marshy hollow near the village of Matsoeberane, between Hlohoeng and the Caledon River, 1½-4 in. high, flowers reddish, *A. Dieterlen*, 942a!; River beds at Hlotse, Leribe District, 2-5 in. high, flowers white, October, *A. Dieterlen*, 809!

DISTRIBUTION: Malmesbury. Cape. Paarl. Swellendam. Somerset East.

SESUTO: *Moriri oa mokhoabo*. The hair of the marsh. *Moriri-oa nōkana*. The hair of the small river. *Moriri oa liliba*. The hair of the fountains. *Mohat'a metsi o monyenyane*. The small one who tramples on the water. This plant is used to make a "medicine" called "Mohatollo" (meaning deliverance from oppression), and is used as a charm when a person is suspected of being bewitched. Also used as a charm in cases of illness. If a child is ill, incisions are made on its body as well as on the body of the mother, in which the "medicine" is placed, and some of the child's blood is put into the mother and *vice versá*. In the case of a grown-up person the same process takes place between him and his nurses.

**C. barklyana**, Schönl.

Ben McDhui, 9450 ft., March, *Galpin*, 6626.

DISTRIBUTION: Endemic.

**C. basutica**, Schönl.

Mountain slopes and plateau. 2-12 in. high, flowers white. Summer.

*A. Dieterlen*, 252a! *ex parte*; Leribe plateau, flowers white, *Phillips*, 716!

DISTRIBUTION: Endemic.

SESUTO: See *C. Harveyi*, Britt. et Bkr. f. Very closely allied to *C. sediflora*, E. & Z., from which it differs in having smooth, not minutely toothed, leaf-margins. The type specimen in our collection has no flowers.

**C. crenatifolia**, Bkr. f.

Natal, Van Reenen, *Schlechter*, 6925.

DISTRIBUTION: Endemic.

Dr. Schönland reports "appears to be identical with *C. umbraticola*, N. E. Br."

**C. Cooperi**, Regel.

Doodman's Kraus Mtn., 8900 ft., March, *Galpin*, 6621.

**var. ?**, Regel.

Basutoland, near the Buffalo River Waterfall, 8250 ft., March, *Galpin*, 6624; Doodman's Kraus Mtn., 9400 ft., March, *Galpin*, 6623, 6624.

**var. robusta**, Schönl. forma foliis hispidis.

Banks of river and mountain slopes. 2-10 in. high, flowers white. Summer. Hlotse, Leribe District, *A. Dieterlen*, 877!

DISTRIBUTION: Hanover.

SESUTO: See *C. Turrita*, Thunb.

**C. curta**, N. E. Br.

Natal, Mahwaqa Mtn., 6-7000 ft., *Wood*, 4592; Drakensberg, 5-6000 ft., March-April, *Wood*, 6081.

DISTRIBUTION: Queenstown.

Dr. Schönland reports "not sharply divided from *C. Cooperi*."

**C. drakensbergensis**, Schönl.

Natal, Van Reenen, 5-6000 ft., March, *Schlechter*, 6962.

DISTRIBUTION: Endemic.

**C. elongata**, Schönl.

Summit Pot River Berg, 6450 ft., March, *Galpin*, 6620.

DISTRIBUTION: Queenstown.

**C. Galpini**, Schönl.

Leribe plateau and slopes of Qoqolosi Peak. 1½–5 in. high, flowers red and white. March, *A. Dieterlen*, 572! 994!; Qoqolosi Peak, flowers white with a dark red centre, *Phillips*, 973!; marshy ground at base of Doodman's Krans Mtn, 8500 ft., March, *Galpin*, 6616!

DISTRIBUTION: Queenstown.

SESUTO: *Mo-ara-matsi*. He who faces the water. *Setsōsa*. A scarecrow. In cases of fatigue, and fever accompanied by pain, the body of the patient is washed with a lotion prepared from the bruised roots.

**C. Harveyi**, Britt. et Bkr. f. (= *C. alpestris*, Harv. non Thunb., *C. laxa*, Schönl.).

Mountain slopes and plateau. 3–8 in. high, flowers white. Summer. *A. Dieterlen*, 252!; Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1823! Bester's Vlei, near Witzie's Hoek, 5000–5400 ft., December–January, *Flanagan*, 1838! *Bolus*, 8160!; Tsitsa Footpath, Drakensbergen, 7400 ft., March, *Galpin*, 6615.

DISTRIBUTION: Van Rhynsdorp. Clanwilliam.

SESUTO: *Setsōsa*. A scarecrow. *Serelinenyana*. The small slippery one. See also *C. setulosa*, Harv.

**C. natalensis**, Schönl.

Mountain slopes. 4–15 in. high, flowers white. Summer. Thaba PKatsoa, Leribe District, *A. Dieterlen*, 696!

DISTRIBUTION: Natal.

SESUTO: *Bohobe ba setsumi*. The bread of the hunter. A decoction is made from the plant and drunk for sore throat. It is also used as a lotion for sore eyes.

**C. setulosa**, Harv.

Slopes of Qoqolosi Peak. 3–8 in. high, flowers white. February–March. *A. Dieterlen*, 969! mountain slopes and plateau, 2–10 in. high, flowers white. Summer. *A. Dieterlen*, 252c!; Qoqolosi Peak, flowers white, *Phillips*, 941!

DISTRIBUTION: Transvaal.

SESUTO: *Setsōsa*. A scarecrow. *Serelilenyana*. The small slippery one. A decoction is made from this plant and given to a child, born after the death of an elder brother or sister, to drink. It is then supposed to act as a charm. Mixed with tobacco the plant is smoked.

**C. Turrita**, Thunb.

Mountain slopes and plateau. 3–10 in. high, flowers white. Spring–Summer. *A. Dieterlen*, 418a!



DISTRIBUTION : Uitenhage. Komgha.

SESUTO : *Serelilenyana*. The small slippery one. *Selatsi*. He who gives rest to. A decoction is made from the plant, after prolonged boiling, and used in chest complaints.

**C. rosularis**, Harv.

Basutoland, near Buffalo River Waterfall, c. 7800 ft., March, *Galpin*, 6617.

DISTRIBUTION : Natal.

**C. transvaalensis**, O.K. (= *C. subulata*, Hook.).

Mountain slopes. 2-6 in. high, flowers yellow. Summer. *A. Dieterlen*, 166a ! Van Reenen, 5500 ft., February, *Wood*, 9806.

DISTRIBUTION : Komgha. Bechuanaland. Orange Free State. Transvaal.

SESUTO : *Moriri oa letlapa*. The hair of the flat stones. As a cure for headache the whole plant is dried, crushed, and then smoked. As a charm, a lotion is made from it. If a native has disturbing dreams about his ancestors his body must be bathed with the lotion by an older person ; this is supposed to bring back dreamless nights.

**C. tenera**, Schönl, M.S. (= *C. mucosa*, Harv. non Linn.).

Mountain slopes. 2-8 in. high, flowers yellow. Summer. *A. Dieterlen*, 166b ! ; south and west slopes of Leribe plateau, growing under shelter of rocks, *Phillips*, 686 ! 859 ! Qoqolosi Peak, *Phillips*, 980 !

DISTRIBUTION : Cape. Albany.

SESUTO : See *C. subulata*, Hook.

*Phillips*, 686 is a form of the species.

**C. mucosa**, Linn.

Basutoland, summit of Buffalo River Waterfall, c. 7800 ft., March, *Galpin*, 6618 !

DISTRIBUTION : Natal.

**C. sp.** (= *Bulliarda Vaillantii*, DC.).

In marsh at the base of Doodman's Krans Mts., 8500 ft., March, *Galpin*, 6613 ; in Vlei at summit of Barkly Pass, 6500 ft., *G. Rattray* in *Herb. Galpin*, 7295.

DISTRIBUTION : Malmesbury. Cape. Port Elizabeth. Queenstown.

**C. limosa**, Schönl. ?

Doodman's Krans Mtn., 9125 ft., March, *Galpin*, 6612.

**C. sp.**

Edge of marsh, Doodman's Kraus Mtn., 8500 ft., March, *Galpin*, 6627.

DISTRIBUTION: Endemic?

**C. sp.**

Natal, Drakensbergen, 6-7000 ft., February, *Evans*, 614.

DISTRIBUTION: Endemic

## GRAMMANTHES, DC.

**G. gentianoides**, DC.

Mountain slopes. Flowers yellow. February. *A. Dieterlen*, 1001!

DISTRIBUTION: Van Rhynsdorp. Malmesbury. Tulbagh. Paarl. Cape. Stellenbosch. Caledon. Swellendam.

SESUTO: *Phalananyana*. Small trumpets. Referring to the shape of the corolla.

## KALANCHOE, Adans.

**K. thyrsiflora**, Harv.

Mountain slopes. 15-26 in. high, flowers yellow. Early spring. *A. Dieterlen*, 496!

DISTRIBUTION: Albany. Queenstown. Philipstown. East Griqualand. Natal. Transvaal (Pretoria, Barberton).

SESUTO: *Serelile*. The slippery one. Used as a charm in cases of difficulty, when matters can be smoothed over. A decoction is made from the plant after being well cooked and given as an enema for intestinal worms. Must be carefully used or it may cause harm. A decoction prepared from the well-cooked roots is drunk by pregnant women who do not feel well. It is said to ease them.

## COTYLEDON, Linn.

**C. orbiculata**, Linn.

Mountain slopes. 10-30 in. high, flowers reddish-yellow. Spring. *A. Dieterlen*, 318!

DISTRIBUTION: Riversdale. Uitenhage. Port Elizabeth. Natal.

SESUTO: *Serelile*. The slippery one. Of use in many diseases. Makes a charm for an orphan child. The native children use the leaves as playthings.

**C. Flanaganii**, Schönl.

Mountain slopes. 20-30 in. high. Flowers reddish-yellow. Spring. *A. Dieterlen*, 497!

DISTRIBUTION. Komgha.

**SESUTO:** *Serelile*. The slippery one. Used as a charm to smooth matters over when a difficulty arises. Used in confinement cases where the birth of the child is difficult. The roots, together with *Commelina africana*, Linn., are used by barren women.

## DROSERACEAE.

### DROSER, *Linn.*

#### **D. Burkeana**, Planch.

Mountain slopes, growing on rocks or sand. 3-9 in. high, flowers magenta. Summer. *A. Dieterlen*, 742a!

**DISTRIBUTION:** Albany. Komgha. Natal.

**SESUTO:** *Tholoo-metsi*. Picked up in water.

#### **D. ramentacea**, Burch. var. *curvipes*, Sond.

Mountain slopes and plateau growing in rock crevices. 1-3 in. high, flowers magenta. Summer. *A. Dieterlen*, 742b!

**DISTRIBUTION:** Swaziland. Transvaal (Belfast).

**SESUTO:** *Tholoo-metsi*. Picked up in water.

## HALORAGEAE.

### GUNNERA, *Linn.*

#### **G. perpensa**, Linn.

Water courses and damp spots on mountain slopes. 8-30 in. high flowers crimson and yellowish. Summer. *A. Dieterlen*, 378!

**DISTRIBUTION:** Cape. Murraysburg. Somerset East. Komgha. Tembuland. Natal. Swaziland.

**SESUTO:** *Qobo*. Favourite of a chief. A decoction prepared from the cooked roots is drunk in cases of colic, used especially by pregnant women. In certain cases given to cows after calving. The "stalks" are edible when fresh.

## CALLITRICHE, *Linn.*

#### **C. Bolusii**, Sch. & Pax.

Natal, Drakensberg ex *Wood's Natal list*.

**DISTRIBUTION:** King William's Town.

## LYTHRARIACE.

### OLINIA, *Thunb.*

#### **O. cymosa**, Thunb.

Natal, valley in Drakensberg, *Evans*, 385; Mt. Fletcher District, in Pot River Berg Forest, 5500 ft., March, *Galpin*, 6628.

**DISTRIBUTION:** Cape. Swellendam. Albany. Transvaal (Magaliesberg).

**O. micrantha**, Decne.

In Pot River Berg Forest, 5500 ft., March, *Galpin*, 6629; Natal, Drakensberg, 5-6000 ft., May, *Wood*, 4957!

DISTRIBUTION: Natal.

## ONAGRACEAE.

EPILOBIUM, *Linn.***E. hirsutum**, *Linn.*

Dongas and water courses. 18-54 in. high, flowers carmine. Summer. *A. Dieterlen*, 764!

DISTRIBUTION: Cape. Uitenhage. Stockenstroom. Komgha. Natal.

SESUTO: *Nōha*. A snake (so called on account of the twisted fruit). *Letsoai la Balisana*. Salt of the "Balisana" (shepherds). The shepherds lick the leaves and flowers and say they have a pleasant taste; they do not, however, chew or swallow them. *Mosika-nōkana*. He who goes along the small river. The natives believe this plant to be a cure for warts. A thread is dipped into the sap and by means of a needle passed through the wart; if more than one, the thread is put through the largest. The warts will then disappear.

**E. flavescens**, *E. Mey.*

Shady spots on mountain slopes. 8-25 in. high, flowers white. Summer. *A. Dieterlen*, 763!

DISTRIBUTION: Komgha. East Griqualand. Tembuland. Natal.

SESUTO: *Nōha*. A snake.

**E. tetragonum**, *Linn.*

Mountain slopes, Malavaneng, Leribe District. 10-18 in. high, flowers dark brownish-purple. January-March. *A. Dieterlen*, 936!, damp spots on mountain slopes and in dongas, 6-28 in. high, flowers white, carmine or pink, *A. Dieterlen*, 114! 878!; ravines on west slopes of Leribe plateau, flowers white, rare, *Phillips*, 584!, on banks of a stream, flowers white, *Phillips*, 703!

DISTRIBUTION: Cape. Worcester. Uitenhage. Natal.

SESUTO: *Nōha*. A snake. *Nōha ea lōti*. The snake of the high mountain.

LUDWIGIA, *Linn.***L. palustris**, *Ellis.*

Mountain slopes. Flowers yellow. Summer. *A. Dieterlen*, 1002!

DISTRIBUTION: Swellendam. King William's Town. Komgha. Natal. Transvaal (Magaliesberg).

SESUTO: *Se nama thabeng*. It spreads on the mountain.

OENOTHERA, Linn.

*Oe. biennis*, Linn.

Damp spots near river banks.  $1\frac{1}{2}$ –5 ft. high, flowers yellow. Summer. *A. Dieterlen*, 633!

DISTRIBUTION: Cape. Stellenbosch.

SESUTO: *Mōōpeli oa nōka*. He who praises the river. See notes under *Oe. villosa*, Thunb.

*Oe. tetraplera*, Cav.

Veld. 5–18 in. high, flowers pure white. Summer. *A. Dieterlen*, 327!

DISTRIBUTION: Introduced.

SESUTO: *Mōōpeli o mosoeu*. The white one who praises. *Thabela-bosin*. He enjoys the night (the flowers open at sunset).

*Oe. villosa*, Thunb.

Fields and mountain slopes. 15–30 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 169!

DISTRIBUTION: Introduced.

SESUTO: *Mōōpeli*. He who praises. The Basutos use the leaves in the following manner to cure a sick feverish child. A “cake” of fresh cattle dung is burnt until it is red hot and then placed in the sick child’s hut; on the glowing embers leaves are thrown, and they believe that the smoke will drive the sickness and fever away.

PASSIFLOREAE.

GUTHRIEA, Bolus.

*G. capensis*, Bolus.

Summit and slopes of the Mont-aux-Sources, 8–9000 ft., January, *Flanagan*, 2103!; Ben McDhui, 9500 ft., March, *Galpin*, 6630.

DISTRIBUTION: Graaff Reinet.

CUCURBITACEAE.

CUCUMIS, Linn.

*C. myriocarpus*, Naudin.

Mountain slopes near shrubs or rocks. A climber, 3–8 ft. long, flowers yellow. Summer–Autumn. *A. Dieterlen*, 501a! 869!

DISTRIBUTION: Cape. Uitenhage.

SESUTO: *Monyaku*. Meaning unknown. A lotion is prepared from the boiled plants as a “medicine” to prevent “Mashoa,” which are sores that appear on the body of a man who has married a widow



who has not undergone certain rites of purification. It is necessary for both to bathe themselves with the lotion, and for the woman also to anoint herself with fat mixed with the pulverised plants. Men suffering from "Mashoa" are not allowed to go among the cattle.

**C. dissectifolius**, Naudin.

Mountain slopes, twining on rocks, trees, or creeping on the ground. 10–30 in. long, flowers yellow. *A. Dieterlen*, 511!; south slopes of Leribe plateau, above Khaniane, flowers yellow, *Phillips*, 881! 920!

DISTRIBUTION: Natal.

SESUTO: *Monyaku*. Meaning unknown. *Lerakana*. The small climber or creeper. A preparation is made from the roots and used for chest complaints in dogs and tumours in human beings, but must be used with great care, as it is said to be poisonous. A decoction made from the boiled fruits is given as an enema in cases of diarrhoea.

**C. sp.** (near *C. hirsutus*, Sond.)

Mountain slopes. A creeping plant, flowers yellow. April. Morija, *A. Dieterlen*, 999!

SESUTO: *Monyaku*. Meaning unknown. See under *C. myriocarpus*, Naudin.

The material is incomplete. The plant is not so hairy and the leaf is more acuminate than in a specimen of Wood's labelled *C. hirsutus*. The anthers are not appendiculate.

CITRULLUS, *Schrad.*

**C. vulgaris**, *Schrad.*

Mountain slopes and veld. A creeper, 2–4 ft. long, flowers yellow. Summer–Autumn. *A. Dieterlen*, 468!

DISTRIBUTION: Cape. Uitenhage. Albany. Somerset East. Natal.

SESUTO: *Tjoto*. *Thōōmo*. *Makakavane*. Meanings unknown. *Ghōmo*. An explosion. Used as a charm to prevent worms spoiling a crop. The fruit is emptied and filled with plants of *Dicoma anomala*, DC., and bulbs of *Oxalis* spp., and then buried in the fields. It is supposed to drive the worms away. When young, the plant is cooked as a vegetable.

MELOTHRIA, *Linn.*

**M. punctata**, Cogn.

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8163!; in Pot Berg Forest, 5500 ft., March, *Galpin*, 6631.

DISTRIBUTION: Cape. Uitenhage. Albany. George. Natal. Bechuanaland. Transvaal (Barberton).

**M. sp.**

Basutoland, without precise locality, *Cooper*, 949!

PISOSPERMA, *Sond.*

**P. capense**, *Sond.*

Veld and mountain slopes. 5–15 in. high, flowers yellow. Spring. Phatsoa, Leribe District, *A. Dieterlen*, 194a!; Caledon River, *Burke*.

DISTRIBUTION: Komgha.

SESUTO: *Sesepa se linōha*. The soap of the snakes. The crushed roots mixed with water and sprinkled round the huts in summer is supposed to keep snakes away. Together with *Geum capense*, Thunb., a “medicine” is prepared to prevent “insects” being introduced into the stomach by witchcraft. Said to be a cure for colic.

COCCINIA, *W. & Arn.*

**C. hirtella**, *Cogn.*

Mountain slopes, twining on trees and rocks. 5–8 ft. long, flowers pale yellow, fruits bright red. Summer. *A. Dieterlen*, 145!; Lefi’s Kloof, N.E. slopes of Lebribe plateau, a creeper, flowers yellow, *Phillips*, 822!

DISTRIBUTION: Natal.

SESUTO: *Leraka la Balimo*. The climber of the ancestor. If a Masuto has unpleasant dreams about his ancestors (“Balimo”) he is bathed in a hole dug on the threshold of the “lelopa” (the circular yard enclosing a hut) with water in which sun-dried roots and iron-stone are mixed. This ceremony will relieve him of further dreams.

FICOIDEAE.

MESEMBRIANTHEMUM, *Linn.*

**M. musculinum**, *Haw.*

Mountain slopes. 2–5 in. high, flowers yellow. Summer. Thab Phatsoa, Leribe District, *A. Dieterlen*, 142e!

DISTRIBUTION: Middleburg, C.P.

**M. lineolatum**, *Haw.*

Mountain slopes. 1–2 ft. high, flowers magenta. Spring–Summer. *A. Dieterlen*, 142d!

DISTRIBUTION: Caledon. Riversdale.

**M. crassulinum**, *DC.*

Ravines and mountain slopes. 4–12 in. high, flowers white. Spring–Autumn. *A. Dieterlen*, 142c!

DISTRIBUTION: Humansdorp.

**M. incomptum**, Haw.

Mountain slopes and plateau. 3-5 in. high, flowers magenta. *A. Dieterlen*, 142a!; rocks near stream in ravine on west slopes of Leribe plateau, flowers magenta, *Phillips*, 728!

DISTRIBUTION: Uitenhage.

**M. hirtum**, N. E. Br.

Stony places in the Caledon Pass, leading from Witzie's Hoek into Basutoland, c. 7200 ft., December, flowers purple, *Thode*, 15!; Bester's Vlei, near Witzie's Hoek, 6100 ft., December, *Bolus*, 8165!; O. F. S. Ladybrand, c. 4000 ft., *Bertha Rogers in Herb. Bolus*, 13429!

DISTRIBUTION: Natal.

**M. Mahoni**, N. E. Br.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8166!

DISTRIBUTION: Transvaal (Barberton).

**M. nubigenum**, Schltr.

In fissures of rocks, summit of the Mont-aux-Sources, c. 8500 ft., January, flowers yellow, *Thode*, 17!

DISTRIBUTION: Transvaal (Magaliesberg).

**M. sp.** (near **M. Mahoni**, N. E. Br.).

Mountain slopes. 5-25 in. high, flowers magenta. Summer. *A. Dieterlen*, 142b!; Qoqolosi Peak, flowers magenta, *Phillips*, 982!

SESUTO: *Sebabetsane*. The small bitter one. *Mabone*. Lights. *Monontsoa*. The fattened one. *Leghoaba*. Meaning unknown. As a cure for sore and swollen feet the plant is burnt and ground and then placed in incisions made in the feet. This operation is performed at the side of a stream in which the patient places his feet, letting the blood run in the water, and he must remain there until he is relieved. Burnt and ground to a powder it is mixed with tobacco. The above Sesuto names and the uses are common to all the species of *Mesembrianthemum*.

This is probably only a robust or luxuriant form of the above species (*vide* L. Bolus).

**M. sp.**

Caledon heights, opposite Berea Mtn. A creeping plant, 1-3 in. high, flowers yellow. Summer. *A. Dieterlen*, 142f!

The material is too poor for determination.

PHARNACEUM, *Linn.***P. detonsum**, Fenzl.

Mountain and hill slopes. 3-12 in. high, flowers white. Summer.

*A. Dieterlen*, 617 !; on south slopes of Leribe plateau, above Khaniane, flowers white and green, *Phillips*, 876 !

DISTRIBUTION : Uitenhage.

SESUTO : *Mabelebele a joang*. The profuse Kaffir-corn of the grass. See note under *Psammotropha androsacea*, Fenzl.

**P. lineare**, Linn. f.

Bester's Vlei, near 'Witzie's Hoek, 5500 ft., *Flanagan*, 1929 !

DISTRIBUTION : Cape.

**P. dichotomum**, Linn. f.

In gardens of Residency at Peka, Leribe district. Flowers white, March. *A. Dieterlen*, 978 !; base of Doodman's Krans Mtn. and Ben McDhui, 8500-9700 ft., March, *Galpin*, 6632, 6633.

DISTRIBUTION : S.W. Africa. Caledon. Swellendam. Uitenhage. Albany.

SESUTO : *Monyakunyana*. The small "Monyaku." See notes under *Psammotropha androsacea*, Fenzl.

**P. sp.**

Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*, 8164 !

#### PSAMMOTROPHA, *E. & Z.*

**P. androsacea**, Fenzl. (Pl.<sub>3</sub>V, fig. 2).

Mountain slopes and plateau. 3-12 in. high, flowers pale yellow. Summer. *A. Dieterlen*, 295 !; growing on a rock, slopes south of the Mission Station, rare, *Phillips*, 687 ! damp bank near stream on Leribe plateau, flowers green, *Phillips*, 795 !; Mont-aux-Sources, 8000 ft., April, *Dyke in Herb. Marloth*, 5404 ! in *Herb. Musei Austro-Afric.*, 5493 !; Doodman's Krans Mtn. and Ben McDhui, 8600-9650 ft., March, *Galpin*, 6634, 6635.

DISTRIBUTION : Somerset East.

SESUTO : *Mothnyoane*. Meaning unknown. *Senama*. He spreads. A "medicine" for constipation is prepared from the boiled and crushed roots. Incisions are made round the waist, legs, arms, and forehead of the patient, and the mixture rubbed in.

var. **enervis**, Fenzl.

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1872 !

DISTRIBUTION : Pondoland. Natal.

**P. myriantha**, Sond.

Summit of the Mont-aux-Sources, 9500 ft., January. *Flanagan*,

2131 !; Tsitsa Footpath, Drakensberg, 7900 ft., March, *Galpin*, 6636 !; Van Reenen, 5-6000 ft., November, *Wood*, 6728 !

DISTRIBUTION: East Griqualand. Natal. Transvaal (Magaliesberg).

**P. sp.**

Mont-aux-Sources, c. 9300 ft., October, *G. Mann in Herb. Marloth*, 2865 !

LIMEUM, *Linn.*

**L. glomeratum**, E. & Z.

Veld and mountain slopes. 3-10 in. high, flowers yellowish. Summer. *A. Dieterlen*, 108 !; south slopes of Leribe plateau, above Khaniane, flowers yellow, *Phillips*, 880 ! 886 !; Caledon River, December, *Burke*, 308 !

DISTRIBUTION: Queenstown. Natal.

SESUTO: *Lereletsane le lenyenyane*. The small gliding thing. *Thetsvana-Khutsoana*. A small deception.

UMBELLIFERAE.

HYDROCOTYLE, *Linn.*

**H. asiatica**, *Linn.*

Damp places in dongas and on mountain slopes. A prostrate plant, 3-5 in. high, flowers mauve. Summer. *A. Dieterlen*, 619 !

DISTRIBUTION: Cape. Caledon. Uitenhage. Cathcart. Albany. Natal.

SESUTO: *Bolila ba linku*. The sorrel (or sourness) of the sheep. Sheep are said to be fond of it.

ALEPIDEA, *Laroche*.

**A. amatymbica**, E. & Z.

Damp places on mountain slopes. 2-5 ft. high, "flowers" white. Summer-Autumn. *A. Dieterlen*, 32 !; common in ravines, bracts white within, green outside, *Phillips*, 673 ! 723 ! 750 ! 761 !; Natal, Van Reenen, 5-6000 ft., February, *Wood*, 5735 ; between Tent Kop and Antelope Park, 5600 ft., March, *Galpin*, 6641.

DISTRIBUTION: Albany. Beaufort West. Stockenstroom. Tembuland. East Griqualand. Natal. Zululand. Orange Free State, (Dorn Kop). Transvaal (near Barberton, Johannesburg).

SESUTO: *Lesōkō*. Meaning unknown. See under *A. setifera*, N.E. Br.



**A. Jacobsziae**, Dümmer.

Bester's Vlei, near Witzie's Hoek, 5400 ft., January–February, *Miss Jacobsz in Herb. Bolus*, 6344!; Harrismith, *Sankey*, 73; Natal, near Hoffenthal, 4000 ft., *Wood*, 3502.

DISTRIBUTION: Endemic.

**A. setifera**, N. E. Br.

Stony places on mountain slopes. 1–2 ft. high, “flowers” whitish. Summer. *A. Dieterlen*, 440!; southern slopes of plateau, *Phillips*, 666!; near Brakwaal and Van Reenen, 5000 ft., *Wood*, 5630.

DISTRIBUTION: Swaziland. Transvaal (Barberton, Hoggeveldt).

SESUTO: *Lesōkvana*. The small “Lesoko.” The roots are chewed raw or a decoction is made from the roots and drunk by persons suffering with chest complaints.

**A. longifolia**, E. Mey., var. **angusta**, Dümmer.

Natal, Van Reenen, 5–6000 ft., *Wood*, 5735.

DISTRIBUTION: Orange Free State (without locality).

**A. ciliaris**, Laroche.

Mountain slopes. 15–25 in. high, “flowers” white. Summer–Autumn. *A. Dieterlen*, 411!; Mont-aux-Sources, 7–8000 ft., January, *Flanagan*, 2106!

DISTRIBUTION: George. Graaff Riet. Albert. Natal. Transvaal (Caledon River).

SESUTO: *Lesōkvane*. The small “Lesōkō.” See under *A. setifera*, N.E. Br.

**A. Galpinii**, Dümmer.

Ben McDhui on damp slopes, 9200 ft., March, *Galpin*, 6638.

DISTRIBUTION: Endemic.

**A. Galpinii**, Dümmer forma.

Ben McDhui, 9700 ft., March, *Galpin*, 6639.

DISTRIBUTION: Endemic.

**A. natalensis**, Wood & Evans.

Harrismith, 7000 ft., *Sankey*, 62.

DISTRIBUTION: Pondoland, Natal.

**A. Thodei**, Dümmer.

Ben McDhui, and Doodman's Krans Mtn., 8800–9900 ft., *Galpin*, 6540; Mont-aux-Sources, Drakensberg, *Thode in Natal Govt. Herb.* 10770.

DISTRIBUTION: Endemic.

CONIUM, *Linn.***C. chaerophylloides**, Thunb.

Veld, fields, and roadsides. 10–45 in. high, flowers cream. Summer–Autumn. *A. Dieterlen*, 235!

DISTRIBUTION: Caledon. Uitenhage. Herbert. Komgha.

SESUTO: *Lefōkōli*. The feeble one. So called on account of the stem being easily broken.

A lotion is prepared from the plant with which to wash feverish patients.

**C. sp.**

Ben McDhui, 9300–9600 ft., March, *Galpin*, 6645.

The above determination was given by Kew to Mr. Galpin.

BUPLEURUM, *Linn.***B. Mundii**, Ch. & Sch.

Mountain slopes, flowers yellow. December–February. Matalane, Leribe District, *A. Dieterlen*, 832!; southern slopes of plateau, *Phillips*, 665!; slopes of the Mont-aux-Sources, 7–8000 ft., January, *Flanagan*, 2107!; Ben McDhui and Doodman's Krans, 8800–9500 ft., March, *Galpin*, 6642.

DISTRIBUTION: Uitenhage. Albany. Fort Beaufort.

SESUTO: *Lekhase* or *Lekhasi*. A fringe or small leaf. So called on account of the thin leaves.

HETEROMORPHA, *Cham.***H. arborescens**, Ch. & Sch.

Ravines, mountain slopes, and dongas. A tree, flowers yellowish. *A. Dieterlen*, 4! Mate, Leribe District, *A. Dieterlen*, 661!; ravines round Leribe plateau, not common, *Phillips*!

DISTRIBUTION: George. Uitenhage. Albany. Port Elizabeth. Beaufort West. Komgha. Tembuland. Natal. Zululand. Swaziland.

SESUTO: *Monkhvane*. Meaning unknown. *'Maka-tlala*. He who increases the famine. A preparation is made from the leaves and given to children troubled with intestinal worms which cause fainting. This tree is planted in every "lekhotla" in Basutoland, which is an open space near the principal hut of the village chief, where the men congregate to do whatever work they have on hand; it is also the court of justice, and the place where strangers and travellers go to ask for hospitality. An old native doctor informed Madame Dieterlen that the tree acted as a charm in retaining the people near their chief, that they may be faithful to him and make the village prosperous.

The Sesuto name for *Dieterlen* 661 is *Mokhvane o monyenyane*. The small "Monkhvava," which is not planted in the "lekhotla." I have only seen var. *trifoliata* from Basutoland, which also occurs in Albany and Komgha. Var. *collina* has also been recorded from Komgha and var. *integrifolia* from the Albany Division. *Flanagan*, 492 (Komgha), *Wood*, 241,602 (Natal), and *Pearson*, 1396 (Nelspoort), have both ternate and simple leaves, but the shape of the leaves and leaflets approach nearer to var. *ternata* than to the other two varieties. *Stewart*, 128 (Swaziland), has 2- and 3-lobed leaves. The leaflets in *Phillips*, 595, are sometimes divided, usually the terminal leaflet is ternate and the lateral leaflets may either be simple or binate.

# LICHTENSTEINIA, *Cham.*

## *L. interrupta*, E. Mey.

Makokoane, Leribe District, November, *A. Dieterlen*, 937!

DISTRIBUTION: Uitenhage. Port Elizabeth. Komgha. Transkei. Natal. Zululand.

SESUTO: *Tlōrō ea ngoale*. The hat of the "ngoale" (a girl undergoing the tribal initiation rites).

# APIUM, *Linn.*

## *A. sp.*

Ben McDhui, 9300 ft., March, *Galpin*, 6644.

The above determination was given by Kew to Mr. Galpin.

# SIUM, *Linn.*

## *S. Thunbergii*, DC.

Water courses. 12-30 in. high. Summer. *A. Dieterlen*, 410!

DISTRIBUTION: Uitenhage. Somerset East. Herbert. Komgha. Transkei. East Griqualand. Natal.

SESUTO: *Lekhapi. Qaqave*. Meanings unknown. *Lehlatso*. Vomiting. The plant cut in small pieces and boiled in water is used to wash the bodies of persons suffering with headache.

# PIMPINELLA, *Linn.*

## *P. caffra*, Harv.

Mountain slopes. 15-30 in. high, flowers white. Summer. *A. Dieterlen*, 460!; Lefi's Kloof and between the Mission Station and Jonathan's Village; *Phillips*, 570! 848!; Basutoland Mtns., without precise locality, *Thode*!; near Buffalo River Waterfall, 8240 ft., March, *Galpin*, 6643!; summit of Mont-aux-Sources, c. 8850 ft., January, *Thode*, 18!

DISTRIBUTION : Somerset East. Stockenströöm. Komgha. Natal. Swaziland.

SESUTO : *Schoëtjana*. A small carrot. *Mohopu*. Meaning unknown. Used as a charm to drive away the "nōhana" (intestinal worms) and the "thōkōlose" (a mysterious spirit which is supposed to appear at night in certain places and during certain illnesses). As a charm against the latter, burnt roots are used to fumigate the haunted hut, and the inmates of the house wash themselves with a decoction made from the plant. This latter process must be done at night at a distance from the hut.

#### ANTHRISCUS, Hoffm.

##### *A. sylvestris*, Hoffm.

Mountain slopes. 2-4 ft. high, flowers white. Spring-Summer. Makokvane, Leribe District. *A. Dieterlen*, 927!

DISTRIBUTION : A native of Europe and North America.

SESUTO : *Lefōkoli le leholo*. The big feeble one. *Lefōkoli le linoka*. The feeble one of the rivers. The water in which the plant has been boiled is used as a lotion when a person is feeling tired or unwell. See also under *Conium chaerophylloides*, Thunb.

#### PEUCEDANUM, Linn.

*P. caffrum*, Phillips, comb. nov. *Caulis* teres, striatus, glaber. *Folia* radicalia, 10-27 cm. longa, pinnata vel bipinnata; petiolus 2-20 cm. longus, teres, sulcatus, basi dilatus amplexusque, glaber; pinnae 1-3 cm. longae, obovatae, lobatae vel pinnatifidae, basi cuneatae, glabrae; apices loborum mucronati. *Pedunculus* ramis diffundus, striatus, glaber. *Bractae* involucrae basi connatae, aliquando 0, saepius 5-7, ovatae, acuminatae, apice acutae, glabrae. *Umbellae* circiter 15-floriferae. *Pedicellus* 2-1 cm. longus, glaber. *Calyx* obsoletus. *Petala* 1.75 mm. longa, 1 mm. lata, ovata, acuminata, apice acuta, incurva, uninervigera, glabra. *Stamina* incurva; filamenta 1-1.5 mm. longa, glabra; antherae .75 mm. longae, globosae. *Ovarium* 1 mm. longum, 1.25 mm. latum, ovatum, glabrum; stylus obsoletus. *Fructus* 1.4 cm. longus, 6.5 mm. latus, ellipticus, 5-costatus, alatus. *Semen* planum, .5 mm. crassum.

*Stem* terete, striate, glabrous. *Leaves* basal, 10-27 cm. long, pinnate or bipinnate; petiole 2-20 cm. long, terete, sulcate, sheathing at the base, glabrous; pinnules 1-3 cm. long, obovate in outline, lobed or pinnatifid, the apices of the lobes mucronate, wedge-shaped at the base, glabrous. *Peduncle* branched, terete, striate, glabrous. *Involucre* sometimes wanting, usually of 5-7 ovate

acuminate acute glabrous bracts, connate at the base to form a shallow saucer-shaped structure. *Umbel* up to about 15-flowered. *Pedicels* 2 mm. long, elongating in the fruit up to 1 cm. long, glabrous. *Calyx* obsolete. *Petals* 1.75 mm. long, 1 mm. broad, ovate, acuminate, acute, incurved, one-nerved, glabrous. *Stamens* incurved; filaments 1-1.5 mm. long, terete, glabrous; anthers .75 mm. long, globose. *Ovary* 1 mm. long, 1.25 mm. broad, ovate in outline, glabrous; styles obsolete in the flowering stage. *Fruit* 1.4 cm. long, 6.5 mm. broad, elliptic, crowned with the persistent styles, 5-ribbed (3 dorsal and 2 lateral), winged, glabrous: vittae in the furrows. *Seed* flat, .5 mm. thick. *Seseli caffrum*, Meism. in Hook. Lond. Journ. Bot. ii, 533; 'Flora Capensis,' ii, 549; *Anesorrhiza caffrum*, Bth. & Hook. Gen. Plant. i, 913.

East Griqualand, stony places round Kokstad, 4300 ft., December, Tyson, 1672; Tyson in Herb. Norm. Austro-Afric., 1279; Natal, Inanda, November, Wood, 1120; Amanzimtote, 10-50 ft. alt., August, Wood, 11654; Komgha, grassy hills near Komgha, 2000 ft., November, Flanagan, 1090; Leribe, A. Dieterlen, 875.

MacOwan recognised that this plant had been placed in the wrong genus, and he distributed specimens as *Peucedanum Meisnerianum* (Herb. Norm. Austro-Afric., 1279). Wood (List of Flora of Natal, p. 162) quotes this plant under *Anesorrhiza caffra*, Bth. & Hook.

**P. reenensis**, Reching.

Natal, Van Reenen, 5-6000 ft., Penther, 2776.

DISTRIBUTION: Endemic.

## ARALIACEAE.

### CUSSONIA, Thunb.

**C. paniculata**, E. & Z.

Ravines and mountain slopes. A tree, flowers yellowish. Summer. A. Dieterlen, 122!; a large tree growing under the cliffs on the mountain slopes between the Mission Station and Jonathan's Village, Phillips, 623!

DISTRIBUTION: Somerset East. Beaufort West.

SEBUTO: *Motsëtšè*. The bony core of a horn. The natives have a strong belief that some of their complaints are due to the presence of beetles and other "insects" in their internal organs, which have been introduced by witchcraft. A preparation is made from the plant and taken as an enema to get rid of such "beetles" from the intestines. Mixed with *Rhus Zeyheri*, *R. divaricata*, and *Scabiosa columbaria*, Linn., it is used in cases of colic.



## RUBIACEAE.

CEPHALANTHUS, *Linn.***C. natalensis**, Oliv.

Natal. Stony hill at Van Reenen, 5-6000 ft., *Wood*, 6621.

DISTRIBUTION: Natal (Glencoe).

OLDENLANDIA, *Linn.***O. amatymbica**, Kuntze.

Veld, mountain slopes and plateau. 20-30 in. high, flowers whitish. Spring-Summer. *A. Dieterlen*, 33!

DISTRIBUTION: Albany. Queenstown. East Griqualand. Natal. Transvaal (Magaliesberg).

SESUTO: *Mohlatsisa*. He who causes vomiting. *Morokolopōli*. The faeces of a goat (so called on account of round black swellings on the roots). *Matsoāne*. Meaning unknown. *Lehlokoana*. The small piece of grass. *'Ma Ngoakoane*. The mother of "Ngoakoane." A decoction prepared from the plant is administered to wasting children to make them fat and well.

**O. Heynii**, Oliv.

Under rocks and mountain slopes. 2-15 in. high, flowers white. Summer. *A. Dieterlen*, 266!; slopes above the Mission Station, growing near rocks, flowers white, occasional, *Phillips*, 513!

DISTRIBUTION: Natal.

SESUTO: *Seobi*. Meaning unknown.

PENTANISIA, *Harv.***P. variabilis**, Harv.

Mountain slopes. 7-20 in. high, flowers violet. Summer-Autumn. *A. Dieterlen*, 21!; Lefi's Kloof on N.E. slopes of Leribe plateau, flowers blue, *Phillips*, 856!

DISTRIBUTION: Stockenstroom. Komgha. Transkei. East Griqualand. Natal.

SESUTO: *Setima-mollo*. The fire extinguisher. (So called because it relieves the burning pain of boils.) The roots of the plant are well boiled and the infected limb is placed in the lukewarm decoction; after time the boils will discharge and the swelling disappear. The breasts of a woman, after her confinement, are rubbed with a lotion prepared from the plant, and in feverish illness the body of the patient is bathed with the lotion. As a charm against witchcraft it is mixed with other plants and rubbed on pegs placed round the "lelapa"; this prevents the sorcerer from finding the door of the hut.

PLECTRONIA, Linn.

**P. ciliata**, Sond.

Mountain slopes. A shrub 4-7 ft. high. Summer. *A. Dieterlen*, 3!; ravine on west slopes of Leribe plateau, a small tree, the only specimen seen, *Phillips*, 721!

DISTRIBUTION: Albany. Philipstown. Natal.

SESUTO: *Meqōane*. *Seeqane*. *Kheōha*. *Mogāpane*. Meanings unknown. The leaves and bark are used as an enema for people suffering with pains in the abdomen caused by "small dung beetles" in the intestines which have entered the body through the witchcraft of an enemy. Either alone or with *Celastrus buxifolius* it is used as a charm to prevent anyone disturbing a body in a grave.

**P. sp. (Canthium Gueinzii)**, Sond.).

Natal, from coast to 6000 ft. alt., *Wood*.

DISTRIBUTION: Transvaal (Rustenburg).

FADOGIA, Schweinf.

**F. humilis**, Wood & Evans.

Natal, in open ground at Van Reenen, 5-6000 ft., December-March, *Wood*, 4528.

DISTRIBUTION: Endemic.

GALOPINA, Thunb.

**G. circaeoides**, Thunb.

Natal, Oliver's Hoek, 5-6000 ft., January, *Wood*, 3560.

DISTRIBUTION: Knysna. Albany. Uitenhage. Komgha. Transkei. East Griqualand.

ANTHOSPERMUM, Linn.

**A. aethiopicum**, Linn.

Mountain slopes. 1-3 ft. high, flowers yellow. Summer. *A. Dieterlen*, 681!

DISTRIBUTION: Cape. Caledon. Worcester. Stellenbosch.

SESUTO: *Potsana*. The small firewood. Used as fuel.

**A. hedyotideum**, Sond.

Mountain slopes, Malavaneng, Leribe District, flowers yellow. January, *A. Dieterlen*, 908!

DISTRIBUTION: Komgha. Transkei. Tembuland.

SESUTO: *Lefero*. He who makes a roof. People who have assisted in nursing a sick person or have taken any active part in the funeral.

must have a drug, in which this plant enters, placed in incisions made on their bodies. Should they neglect this, their crops will either fail them or be poor.

**A. pumilum**, Sond.

Veld and mountain slopes. 3-15 in. high, flowers whitish. Summer.

*A. Dieterlen*, 172! partly; Caledon River, *Burke*!

DISTRIBUTION: Komgha. Natal.

SESUTO: *Phakisane*. Small haste. *Māsōpōlohane*. He who is broken (by twisting). Used as a charm to hasten the convalescence of a sick person. The plant enters into many medicines and is supposed to hasten healing. A traveller who comes across the plant on his journey takes it as a good omen, and if he stops and repeats a few words he will find good food and welcome at the end of his journey. A native wishing to sell cattle, washes them with an infusion made from the plant and by so doing will sell well and quickly.

var. **pilosum**, Phillips, var. nov.

A typo fructibus pilis hamatis tectis differt.

This differs from the type by the fruits being pilose with hooked hairs.

Mountain slopes. 6-18 in. high, flowers yellow. Summer-Autumn.

*A. Dieterlen*, 629; mountain slopes and veld, flowers cream, *A. Dieterlen*, 172 partly; Qoqolosi Peak, common, *Phillips*, 619, 947.

**A. rigidum**, E. & Z.

Ravines and mountain slopes. Flowers yellow. Summer. *A.*

*Dieterlen*, 922! 970! Natal, stony hill at Van Reenen, 4-5000 ft., December, *Wood*, 4531.

DISTRIBUTION: Namaqualand. Swellendam. East Griqualand.

SESUTO: *Potsana*. The small firewood. *Phakisane*. Small haste.

See also note under *A. hedyotideum*.

**A. humile**, N. E. Br.

Natal, Ulundi, 6-7000 ft., on damp rocks, January, *Evans*, 370.

DISTRIBUTION: Endemic.

RUBIA, *Linn.*

**R. cordifolia**, *Linn.*

Mountain slopes, twining on rocks and shrubs. 10-30 in. high, flowers yellowish. Summer. *A. Dieterlen*, 331b!

DISTRIBUTION: Uitenhage. Transkei. East Griqualand. Natal.

SESUTO: *Seharane*. He who entwines. *Mo-hlatsoa-meno*. He who washes the teeth. A decoction made from the roots is drunk for colic,

sore throat and chest complaints; it is also used to wash the teeth. If a witch-doctor loses a patient by death, he washes his "divining bones" in the decoction to purify them. A man wishing to become a witch-doctor drinks the decoction; this will give him intelligence and judgment, and the various ways of using the "divining bones" will become clear to him.

**GALIUM, Linn.**

**G. wittbergensis, Sond. (*ex descr.*).**

Mountain slopes. Flowers yellow. Spring-Summer. *A. Dieterlen*, 50! *ex parte*; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1935! *Bolus*, 8170!; rocky wet places on the Wittebergen, 6-7000 ft., *Drège*.

DISTRIBUTION: Endemic.

**var. glabrum, Phillips, var. nov.**

A typo ramis glabris differt.

This only differs from the specimen cited under the type in having perfectly glabrous branches.

Mountain slopes. 4-18 in. high, flowers yellow. Summer. *A. Dieterlen*, 40! *ex parte*; flowers yellow, *Phillips*, 713!

DISTRIBUTION: Endemic.

SESUTO: *Morarana oa mangope*.

*Seharane*.

**G. dregeanum, Sond. forma.**

Mountain slopes, twining on rocks or shrubs. 6-25 in. high, flowers yellowish. Summer. *A. Dieterlen*, 331a!

DISTRIBUTION: Endemic.

SESUTO: *Seharane*. Derived from the verb "ho harana"—to coil one with another. See note under *Rubia cordifolia*.

**G. rotundifolium, Linn.**

Mountain slopes, under rocks, 3-15 in. high, flowers white. Summer. *A. Dieterlen*, 146!; mountain slopes south of the Mission Station, flowers white, *Phillips*, 688! shady places in ravine on west slopes of Leribe plateau, *Phillips*, 749! Lefi's Kloof on N.E. slopes of Leribe plateau, under rocks, *Phillips*, 972!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1886!

DISTRIBUTION: Stockenstroom. Somerset East. Natal. Bechuana-land.

SESUTO: *Moriri-oa-lehala*. The hair of the cave. *Lefero*. He who gets entwined. See note under *Rubia cordifolia*.

var. *hirsutum*, Sond.

Natal. Oliver's Hoek, 5000 ft., *Wood*, 3558.

DISTRIBUTION: Endemic.

## VALERIANEAE.

### VALERIANA, Linn.

**V. capensis**, Thunb.

Mountain slopes on the banks of streams. 10-30 in. high, flowers white. Summer. *A. Dieterlen*, 278!

DISTRIBUTION: Natal.

SESUTO: *Motetele*. Meaning unknown. The leaves are burnt in the hut of a sick person to drive away the illness.

## DIPSACEAE.

### CEPHALARIA, Schrad.

**C. ustulata**, R. & Sch., var. *pilosa*.

Veld, mountain slopes, and river banks. 15-35 in. high, flowers white. Summer. *A. Dieterlen*, 161!; Caledon River, *Zeyher*, 307! 789!; Harrismith, 5000 ft., February, *Wood*, 4839!

DISTRIBUTION: Endemic.

SESUTO: *Tsöene*. A monkey. The crushed roots are placed on embers and used to fumigate a hut visited by a "thokolose" (a fabulous being believed in by the natives) to drive it away. It is also used to rid the body of "insects" which have entered through the witchcraft of an enemy.

### SCABIOSA, Linn.

**S. columbaria**, Linn.

Veld and mountain slopes. 9-32 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 12!; common round the Leribe plateau, flowers white, *Phillips*, 583! 763! 769! 946!

DISTRIBUTION: Natal. Cape. Tulbagh. Albany. Pondoland. East Griqualand.

SESUTO: *Selömi*. Colic pains. *Tlhaku ea pitsi*. The leg of the horse. Mixed with *Rhus divaricata* and *Cussonia paniculata* it is employed for colic pains and painful menstruation. Also used in cases of difficult confinement.

var. *dissecta*, Sond.

Wolve Kop. Caledon River, *Zeyher*!

DISTRIBUTION: Cape. Uitenhage. Albany. Komgha.



*. africana*, Linn.

Natal. Van Reenen, 5-6000 ft., March, *Wood*, 5613. Rare.

DISTRIBUTION: Cape.

## COMPOSITAE.

### VERNONIA, *Schreb.*

#### **V. Kraussii**, Sch. Bip.

Veld and mountain slopes. 10-22 in. high, flowers violet. Summer-Autumn. *A. Dieterlen*, 1!; slopes between the Mission Station and Jonathan's Village, common, *Phillips*, 568! Left's Kloof on N.E. slopes of Leribe plateau, flowers blue, *Phillips*, 819!

DISTRIBUTION: East Griqualand. Transkei. Pondoland. Zululand. Bechuanaland. Orange Free State (Rietfontein, Bloemfontein). Transvaal (Barberton, Ermelo).

SESUTO: *Mofefa-bana*. The wiper of the children. Used to wipe dirt from children. The smoke from this plant is supposed to divert an approaching hailstorm.

#### **V. natalensis**, Sch. Bip.

Basutoland, without precise locality, *Cooper*, 944!; summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1950!

DISTRIBUTION: East Griqualand. Natal. Transvaal (Belfast, Barberton, Lydenburg).

#### **V. pinifolia**, Less.

Mountain slopes. 15-30 in. high, flowers purple-lilac. Summer. *A. Dieterlen*, 368! 876!; ravine on west slopes of Leribe plateau, common, *Phillips*, 613!

DISTRIBUTION: George. Somerset East. Graaff Reinet. Natal.

SESUTO: *Mofefa bana oa thaba*. The "mountain" children's wiper. See note under *V. Kraussii*, Sch. Bip.

#### **V. hirsuta**, Sch. Bip.

Dongas and mountain slopes. 20-40 in. high, flowers violet. Summer. *A. Dieterlen*, 373!; Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8174!

DISTRIBUTION: Transkei. East Griqualand. Natal. Zululand. Transvaal (Barberton).

SESUTO: *Phefo e kholo*. The big wind. *Hlelehlele*. Meaning unknown. *Sechèè*. Meaning unknown. Mixed with other plants, is an antidote for colic pains. The boiled roots are used together with other plants for many diseases.



var. **Flanaganii**, Phillips, var. nov. *Folia* basi angustata non cordata.  
*Bracteae* involucrae longo-acuminatae, pappo aequales.

This differs from the type in the leaves not being cordate at the base. The involucral bracts are longer and more acuminate, and equal or exceed the pappus.

Eland's River Valley, near the Mont-aux-Sources, 6200 ft., December, *Flanagan*, 1947; Mont-aux-Sources, 6000 ft., October, *A. Bolus* in *Herb. Guthrie*, 4820.

DISTRIBUTION: Endemic.

### V. stipulacea, Klatt.

Natal, Drakensberg, *Bolus*, 3004.

DISTRIBUTION: Endemic.

## GARULEUM, Cass.

### G. Woodii, Schinz.

Basutoland, rocky ridges near the Buffalo River Waterfall, c. 7450 ft., March, rays blue, *Galpin*, 6660!

DISTRIBUTION: Natal (Charlestown, 5–6000 ft.)

## ASTER, Linn.

### A. petiolatus, Harv.

Damp spots on mountain slopes. A creeping plant, 4–36 in. long, flowers pink-mauve. Winter–Spring–Summer. *A. Dieterlen*, 343!; ravine on west slopes of Leribe plateau, rays light pink, *Phillips*, 768!; Basutoland, without locality, *Cooper*.

DISTRIBUTION: Albert.

SESUTO: *Khōtōliea ea thaba*. The “*Khōtōliea*” of the mountain. (The name “*Khōtōliea*” is given to many of the *Compositae*, the meaning is unknown.) After a native burial, the members of the deceased's family, and those who took an active part in the burial, have incisions made on their bodies by the native doctors and a preparation made from this plant is rubbed in, the belief being that by so doing they will have a normal crop of corn and mealies. If this ordeal is neglected their crops will not produce grain.

I have not seen an authenticated specimen of this species, but our plant agrees with the description and figure in *Harv. Thes. t.* 154.

### A. natalensis, Harv.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1950!

DISTRIBUTION: Somerset East. Transvaal (Devil's Kantoor).

**A. filifolius**, Vent.

Mountain slopes.  $1\frac{1}{2}$ –4 ft. high, flowers mauve. Early Spring. *A. Dieterlen*, 27!; grassy stony hillsides at Zaaihoek, Harrismith, c. 5700 ft., May, *Thode*!

DISTRIBUTION: Pondoland. Aliwal North. Oudtshoorn. Natal. Graaff Reinet. Prince Albert. Clanwilliam. Transvaal (Pretoria, Lydenburg).

SESUTO: *Leholo*. Meaning unknown. Used as firewood.

**A. hispidus**, Bkr. non Thunb.

Mountain slopes. 10–22 in. high, flowers violet. Summer. *A. Dieterlen*, 133! Mechachaneng, Qalo District, January, *A. Dieterlen*, 907!; Bester's Vlei, near Witzie's Hoek, 6100 ft., December, *Bolus*, 8176!; Mont-aux-Sources, 8000 ft., October, *A. Bolus in Herb. Bolus*, 6011!

DISTRIBUTION: Natal. King William's Town. Transkei. Aliwal North. Albany. East Griqualand.

SESUTO: *Phōa*. Derived from “Sephōa”—smoothness. The boiled roots, mixed with *Helichrysum callicomum*, Harv., and *H. rugulosum*, Less., are given as an enema for colic. The plant used with *H. callicomum*, Harv. alone, makes a “Lenaka” (a protective charm).

**A. perfoliatus**, Oliv.

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8175!; Cathkin Peak, 8000 ft., November, *A. Bolus in Herb. Bolus*!; rocky hill, Drakensberg, 5000 ft., January, *Wood*, 3605.

DISTRIBUTION: East Griqualand.

**A. quinquenervis**, Klatt.

Natal, edge of wood, Polela, 5–6000 ft., April, *Fourcade*.

DISTRIBUTION: Endemic.

**A. uliginosus**, Wood & Evans.

Summit of the Mont-aux-Sources, 11,000 ft., March, *Evans*, 758!; in damp places, sources of the Tugela River, *Evans*, 758.

DISTRIBUTION: Endemic.

**A. Woodii**, Klatt.

Natal, Van Reenen, 5–6000 ft., December, *Wood*, 4521.

DISTRIBUTION: Tembuland.

**. sp.**

Natal, in swamps, Mont-aux-Sources, 10–11,000 ft., March, *Evans*, 739.

DISTRIBUTION: Endemic?

## FELICIA, Cass.

**F. hirsuta**, DC.

Bester's Vlei, near Witzie's Hoek, 5400 ft., January, *Bolus*, 8179!

DISTRIBUTION: Namaqualand Minor.

**F. amelloides**, Schltr.

Sandy and stony places on banks of rivulets, summit Mont-aux-Sources, c. 8700 ft., January. Shrubby, rays blue, *Thode*, 19!

DISTRIBUTION: Endemic.

According to the descriptions this is probably the same as *F. drakenbergensis*, W. & E.

**F. muricata**, Nees.

Veld, mountain slopes, and plateau. 5–15 in. high, rays white or mauve. Spring to end of Autumn. *A. Dieterlen*, 263!; south slopes of Leribe plateau above Khaniane, rays bluish, *Phillips*, 917! west slopes of Leribe plateau, and slopes south of the Mission Station, rays mauve, frequent, *Phillips*, 636! 661!

DISTRIBUTION: Natal. Griqualand West. Tembuland. Murraysburg. Graaff Reinet. Aliwal North. Transvaal (Carolina).

SESUTO: 'Ma-mileng. Mother of the road. *Mohantsoāne*. *Koelehane*. Meanings unknown. A medicine to relieve headaches, and for giving cows that are ill after calving, is prepared from this plant.

**F. drakensbergensis**, W. & E.

Natal, sources of Tugela River, 11,000 ft., *Evans*, 747.

DISTRIBUTION: Endemic.

**F. linearis**, N. E. Br.

Grassy slopes, valley above Buffalo River Waterfall, c. 8400 ft., March. Rays blue, *Galpin*, 6661!; Natal Amawahqua, 6–7000 ft., April, *Wood*, 4631.

DISTRIBUTION: Endemic.

**F. pinnatifida**, Wood & Evans.

Summit Mont-aux-Sources, March, *Evans*, 739!; base of Doodman's Krans Mtn., 8500 ft., March. Rays blue, *Galpin*, 6662!

DISTRIBUTION: Endemic.

## ERIGERON, Linn.

**E. canadense**, Linn.

Veld and dongas. 6–40 in. high, heads whitish. Summer–Autumn. *A. Dieterlen*, 88! 339!; west slopes of Leribe plateau, heads white, *Phillips*, 616!

DISTRIBUTION: Natal.

**SESUTO: Mokoteli.** He who drives away a calf from its mother when she is milked. *Lehanunyana*. The small "Lehamu" *Setsohat-sana sa Basia*. The old woman of the "Basiea" (a tribe of the northern Transvaal, related to the Basutos). "Old woman" because of its greyish appearance. *Lehamu*. Meaning unknown. A decoction is made from the leaves and drunk for sore throat. Used for a preparation to cure ringworms, and to make lotions to wash sick children. In winter it is used as a fuel. The Basutos distinguish as separate plants *Dieterlen*, 88 and 339, and put them to different uses; they are merely forms of the one species.

**NIDORELLA, Cass.**

**N. hirta, DC.**

Veld and mountain slopes. 10-30 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 513!; near Eland's River at the foot of the Mont-aux-Sources, December, *Flanagan*, 1958! *Flanagan in Herb. Bolus*, 6471!

**DISTRIBUTION:** Transvaal (Lydenburg).

**SESUTO: Mokoteli o mosehlo.** The yellow "Mokoteli." Used for fumigating a hut when a child is feverish. Burnt in winter as fuel.

**N. foetida, DC.**

Mountain slopes. 18-30 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 892!; near Buffalo River Waterfall, 8100 ft., March, *Galpin*, 6663, 6664.

**DISTRIBUTION:** Cape.

**SESUTO: Mokoteli.** He who drives a calf away from its mother when she is milked. Used as fuel in winter.

The above name (*Galpin*, 6664) was given by Kew to Mr. Galpin, though Dr. Bolus identified No. 6664 as *N. resedaefolia*, DC.

**N. undulata, Sond.**

Mountain slopes. 15-35 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 559!

**DISTRIBUTION:** Uitenhage. Albany. Eastern Districts.

**SESUTO: Mokoteli o mohofo.** The big "Mokoteli." The name "Mokoteli" is given to all species of *Nidorella* and a few other plants. Used in winter as fuel.

**N. depauperata, Harv.**

Veld and mountain slopes. 10-25 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 722!, Corn Exchange, Tsikoane, *A. Dieterlen*, 884!, ravine at Matalane, *A. Dieterlen*, 882!; Bester's



Vlei, near Witzie's Hoek, 5300–5500 ft., December–January, *Bolus* 8177! *Flanagan*, 1995!

DISTRIBUTION: Griqualand West. Griqualand East. Pondoland. Natal. Queenstown. Transvaal (Ermelo, Pretoria).

SESUTO: *Mokoteli*. See *N. foetida*, DC. Used as fuel in winter.

**N. polycephala**, DC. (*ex descr.*).

River banks. 3–5 ft. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 750!

DISTRIBUTION: East Griqualand.

SESUTO: *Phefo ea noka*. The wind of the river. Used as fuel.

This is an exact match with *Tyson*, 1510, from East Griqualand, both agree with the description of *N. polycephala*, DC., though in a note on a sheet in the Bolus herbarium, Mr. N. E. Brown says *cf. N. polycephala*, DC.

CONYZA, Less.

**C. podocephala**, DC.

Veld, dongas, and mountain slopes. 14–23 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 10!; various localities, round Leribe plateau, common, *Phillips*, 520! 605! 670! 924! 938!

DISTRIBUTION: Natal. Tembuland. Aliwal North. Orange Free State (near Bethulie). Transvaal (Middleburg, Oliphant's River).

SESUTO: *Manku a meholo*. Many big sheep. Said by the natives to be a very valuable plant for fumigation purposes in cases of illness. A decoction is made from the roots and given to feverish patients to drink.

**C. pinnatilobata**, DC.

River banks and mountain slopes. 12–30 in. high, flowers yellow. Summer. *A. Dieterlen*, 818!; near Buffalo River Waterfall, 8100 ft., March, *Galpin*, 6665.

DISTRIBUTION: Natal. Cape. Graaff Reinet. Transkei.

SESUTO: *Sekhatlana se seholo*. The big leaf. Mixed with *Amphidoza gnaphaloides*, DC., it is crushed and burnt in a sick room to drive away the illness.

**C. obscura**, DC.

Mountain slopes. 12–25 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 628!

DISTRIBUTION: Natal. Albert. Swaziland. Graaff Reinet. Transvaal (Houtbosch).

SESUTO: *Phefo ea meru*. The wind of the forests. See note under *C. podocephala*, DC.

NOLLETIA, *Cass.*

**N. ciliaris**, Steetz.

Veld and mountain slopes. 5–20 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 359!

DISTRIBUTION: Natal. Griqualand West. Orange Free State (Bethulie).

SESUTO: *Moloka*. He who is straight. The leaves are smoked as a cure for headache. As a charm against witchcraft, the plant is reduced to ashes and mixed with goat's fat and burnt in the hut, the smoke is supposed to counteract the influence of witchcraft.

**N. rarifolia**, Steetz.

Natal, slopes of the Drakensberg, 4–5000 ft., January, *Wood*, 3957.

DISTRIBUTION: Natal. Transvaal (Pretoria, Irene).

CHRYSOCOMA, *Linn.*

**C. tenuifolia**, Berg.

Veld and mountain slopes. 10–22 in. high, flowers yellow. Summer–Autumn. *A. Dieterlen*, 463! Shady places in ravine on west slopes of Leribe plateau, *Phillips*, 724! Drakensberg, *Wood*, 3081.

DISTRIBUTION: Namaqualand Minor. Matjesfontein. Ladysmith. Prince Albert. Aliwal North. Tembuland. Natal. Orange Free State (Bloemfontein). Transvaal (Heidelberg).

SESUTO: *Sehala-hala*. A bush.

HETEROMMA, *Benth.*

**H. decurrens**, Benth.

Water courses and damp spots on mountain slopes. 1–4 ft. high, flowers yellow. *A. Dieterlen*, 438! ravine on west slopes of Leribe plateau, flowers yellow, *Phillips*, 777! Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8178!, 6600 ft., December, *Flanagan*, 1858!; summit of Drakensberg, near Van Reenen, 6000 ft., February, *Wood*, 9294.!

DISTRIBUTION: East Griqualand.

SESUTO: *Moghoboghobo o mohola*. The big "Moghoboghobo."

var. **pterocaula**, Harv.

Basutoland, near Buffalo River Waterfall, 8150 ft., March, a branching shrublet, 4 ft. high, *Galpin*, 6666! Rensberg Kop, Orange Free State, 5–6000 ft., February, *Wood*, 9294!

DISTRIBUTION: Endemic.

**H. simplicifolia**, Wood & Evans.

Drakensberg, near Polela River, 6-7000 ft., February, *Evans*, 648;  
Van Reenen, 5500 ft., January, *Wood*, 10765!

DISTRIBUTION: Endemic.

TARCHONANTHUS, *Linn.***T. camphoratus**, *Linn.*

Mountain slopes. A tree, flowers yellowish. Spring. *A. Dieterlen*, 565!

DISTRIBUTION: Cape. Albany. Natal. Griqualand West. Transvaal (Barberton, Crocodile River).

SESUTO: *Mofahlana*. Derived from the verb "ho fahlo"—to dazzle. The crushed branches are burnt and the smoke inhaled as a cure for headache. Used as firewood and for making walking-sticks.

DENEKIA, *Thunb.***D. capensis**, *Thunb.*

Damp spots. 3-12 in. high, flowers violet, lilac or mauve. Summer-Autumn. *A. Dieterlen*, 530a! also at Tsikoane. *A. Dieterlen*, 530b!

DISTRIBUTION: Albany. East Griqualand. Natal. Transvaal (Pietersburg, Pretoria). Rhodesia.

SESUTO: *Tōane-mohlaka*. The "Tōane" of the marsh. ("Tōane" is a name given to many plants with woolly leaves.) Shepherds weave hats with the plant.

AMPHIDOKA, *DC.***A. gnaphaloides**, *DC.*

Veld. 2-12 in. high, flowers white. Summer. *A. Dieterlen*, 703!

DISTRIBUTION: Worcester. Wellington. Natal. Transvaal (Pretoria).

SESUTO: *Mosuvane oa naha*. The "Mosuvane" of the country. *Toanenyane*. The small "Tōane." See note under *Conyza pinnatifida*, *DC.*

GNAPHALIUM, *Linn.***G. undulatum**, *Linn.*

Veld and mountain slopes. 6-38 in. high, flowers whitish-yellow. Summer-Autumn. *A. Dieterlen*, 5!; Doodman's Krans Mtn., c. 9000 ft., March, *Galpin*, 6688!

DISTRIBUTION: Calvinia. Cape. Graaff Reinet. Tembuland. Natal.

SESUTO: *Mothepletelle*. Meaning unknown. *Phefo*. The wind.

The plant is burnt, either alone or with other species of *Gnaphalium*, in the hut of a feverish child to drive away the illness.

**G. luteo-album**, Linn.

Mountain slopes. 6–20 in. high, flowers whitish. Autumn. *A. Dieterlen*, 315!

DISTRIBUTION: Cape. Graaff Reinet. Prince Albert. Transkei. Natal. Transvaal (Zuikerbosch).

SESUTO: *Mosuvane*. He on whom skins are rubbed to become supple. *Manku*. Many sheep. Bundles of the plant are laid on the ground to form mats on which skins are worked. See note under *G. undulatum*, Linn.

**G. sp.**

Veld and gardens. 2–12 in. high, bracts yellowish. Spring. *A. Dieterlen*, 727!

DISTRIBUTION: Somerset East. Tembuland.

SESUTO: *Mosuvane oa mosimo*. The “mosuvane” of the lands. The plant is incinerated, crushed, and mixed with fat, this mixture is smeared on a bamboo which is planted in the village and acts as a charm against lightning. Together with *G. undulatum* and *G. luteo-album* it is used to fumigate the room of a sick child.

*Dieterlen*, 727 = *Baur* 760. On a sheet in the Bolus Herbarium is the following note by Mr. N. E. Brown: “This scrap (all that can be spared) = *Macowan* 643, Boschberg, distributed as *Helichrysum declinatum*, Less. var. and also = *Gnaphalium candidissimum*, Lam. a of Drège’s distribution. If it is not *G. micranthum*, Thunb., it is probably new.” I have compared this specimen with a sheet in our herbarium labelled in Harvey’s handwriting *G. micranthum*, Thunb., but the specimens differ considerably. Not having seen the type, I hesitate to describe the plant as new. The involucral scales are described by Harvey as “snow-white,” in *Dieterlen*, 727, they are “yellowish.”

HELICHRYSUM, Gaertn.

*capillaceum*, Less.

Leribe, ravine and mountain slopes under rocks. 4–10 in. high, bracts white. Summer. *A. Dieterlen*, 754!; damp rocks in ravine between the Mission Station and Jonathan’s village, *Phillips*, 854!; Natal, Polela, Drakensberg, 6–7000 ft., July, *Evans*, 579!

DISTRIBUTION: Cape. Worcester. Albany. Uitenhage. Queens-town. Murraysburg. Graaff Reinet. Molteno. Komgha. Natal.

SESUTO: *Mosuvane oa lehaho*. The “Mosuvane” of the cave. Used to cure chest complaints in children.

**H. ericaefolium**, Less.

Barkly East at Rhodes, 6150 ft., March, *Galpin*, 2326!

DISTRIBUTION: Cape. Natal.

var. **albidulum**.

Veld and mountain slopes. A creeping plant, 2-8 in. long, bracts pink. Spring-Summer. *A. Dieterlen*, 522!

DISTRIBUTION: Albany. Orange Free State (Boshof).

SESUTO: *Tōane ea matlapa*. The "tōane" of the flat stones.

**H. caespitum**, Sond.

Veld, mountain slopes, and plateau. A prostrate plant, 3-8 in. long. Early spring. *A. Dieterlen*, 139!; Basutoland, without precise locality, *Cooper*, 751!

DISTRIBUTION: Queenstown. Natal. Griqualand West. Transvaal (Rustenburg, Pretoria, Ermelo).

SESUTO: *Selelu sa phooko*. The chin of the he-goat. *Moriri oa naha*. The hair of the country. *Moriri oa setsohali*. The hair of the old woman. The plant is crushed and burnt, and the smoke inhaled as a cure for colds in the head or chest. A decoction of the roots cures nausea; it does not bring on vomiting.

**H. Sutherlandi**, Harv.

Mountain slopes, usually overhanging rocks. 5-30 in. high, bracts white. Summer-Autumn. *A. Dieterlen*, 447!; on western and southern slopes of Leribe plateau, *Phillips*, 730! 873!; Basutoland, without precise locality, *Cooper*, 709; Mont-aux-Sources, 8000 ft., April, *Dyke in Herb. Marloth*, 5429! *in Herb. Musei Austro-Afric.*, 5509!; Witteberg, at Caledon River, *Rehmann*, 3951!; Natal, summit of Mahwaqua, 6800 ft., April, *Wood*, 972!; Cathkin Peak, 8350 ft., *West in Herb. Musei Austro-Afric.*, 4585!

DISTRIBUTION: East Griqualand (Ingeli Mountain, 7000 ft.).

SESUTO: *Molepellè*. He who hangs down. *Senkotvana*. Meaning unknown. The plant is incinerated and crushed, and the powder put in incisions made on the body of a sick person.

var. **semiglabra**, N. E. Br.

Natal, Van Reenen, 5000 ft., March, flowers white. *Wood*, 5702!

DISTRIBUTION: Endemic.

**H. Ernestianum**, DC.

Bester's Vlei, near Witzie's Hoek, 6000 ft., December, *Bolus*!, *Flanagan*, 1895!

DISTRIBUTION: Somerset East. Graaff Reinet.



**H. sessile**, DC.

Mont-aux-Sources, c. 9300 ft., October, *Mann in Herb. Marloth*, 2875!; Cathkin Peak, 7100 ft., September, *West in Herb. Musei Austro-Afric.*, 4586!; Doodman's Kraus Mtn., 9650 ft., March, *Galpin*, 6668!

DISTRIBUTION: East Griqualand.

**H. chionosphaerum**, DC. (Pl. VI, fig. 4).

Dry spots on plateau. A creeping plant, bracts white and yellow. Spring-Summer. *A. Dieterlen*, 128!; Bester's Vlei, near Witzie's Hoek, 6500 ft., December, *Bolus*, 8182!; summit of the Mont-aux-Sources, 8-10,000 ft., October, *A. Bolus in Herb. Bolus*, 6864!; Natal, Niginya, 5500 ft., October, flowers white, *Wood*, 10539!; Caledon River, Wolve Kop, *Zeyher*, 22! 873!; Wittebergen, *Drège*!

DISTRIBUTION: Molteno. Albert. East Griqualand. Natal.

SESUTO: *Molèpellè*. *Senkotoana*. See meanings under *H. Sutherlandi*, Harv.

**H. marginatum**, DC.

High mountain slopes at Machaëhe, Thaba Bosin District, *A. Dieterlen*, 851!; summit of the Mont-aux-Sources, 9500 ft., March, *Galpin*, 6675!; Wittebergen, 7-8000 ft., *Drège*!

DISTRIBUTION: Stockenstroom. East Griqualand. Natal.

SESUTO: *Tōane Balingvana e tsöeu*. The white "Tōane" of the small ancestors.

**H. adenocarpum**, DC.

Mountain slopes and plateau. 4-15 in. high, bracts pink and white. Summer-Autumn. *A. Dieterlen*, 272!; Natal, Van Reenen, 5-6000 ft., *Wood*, 4530; March, *Schlechter*, 6927!; Tsitsa Footpath, Drakensberg, 6900 ft., March, *Galpin*, 6674!

DISTRIBUTION: Victoria East. Stutterheim. Komgha. Tembuland. East Griqualand. Swaziland. Transvaal (Volksrust, Barberton, Lydenburg).

SESUTO: *Tōane-Balingvana*. The "Tōane" of the small ancestors. A decoction is prepared from the roots and used to cure diarrhoea and vomiting in children.

**H. elegantissimum**, DC.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1966!; Basutoland, near the Buffalo River Waterfall, 8150 ft., *Galpin*, 6679.

DISTRIBUTION: Tembuland. East Griqualand. Natal. Swaziland. Transvaal (Barberton).

**H. Cooperi**, Harv.

Margin of Forest, Pot River Berg, 5500 ft., March, *Galpin*, 6678.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Ermelo, MacMac).

This name was given by Kew to Mr. Galpin.

**H. setosum**, Harv.

Mountain slopes. 12–30 in. high, bracts bright yellow. Autumn. *A. Dieterlen*, 446! *ex parte*; Qoqolosi Peak, and common round slopes of Leribe plateau, *Phillips*, 677! 783! 871! 875! 954!; Natal, Ulundi, –6000 ft. November, *Evans*.

DISTRIBUTION: Natal. Orange Free State (Parys). Transvaal (Rustenburg, Barberton, Houtbosch).

SESUTO: *Phefo ea Thaba*. The wind of the mountain. *Bohlōko*, Suffering. Used to fumigate rooms.

**H. fulgidum**, Willd.

Mountain slopes. 12–30 in. high, bracts bright yellow. Autumn. *A. Dieterlen*, 446! *ex parte*; mountain slopes and plateau, 6–15 in. high, bracts bright yellow. Spring–Summer. *A. Dieterlen*, 270!; slopes of Mont-aux-Sources, above the Eland's River, 8000 ft., January, *Flanagan*, 1961!; Cathkin Peak, 10,000 ft., November, *A. Bolus in Herb. Guthrie*, 4833!

DISTRIBUTION: Graaff Reinet. Queenstown. Transkei. East Griqualand. Natal. Transvaal (Pretoria, Lydenburg, Waterval Boven). Delagoa Bay.

SESUTO: *Leabane*. The small vase. A decoction is used for washing sore eyes.

**H. lanatum**, Harv., var. **oreophilum**, Klatt (= *H. oreophilum*, Klatt).

Bester's Vlei, near Witzie's Hoek, c. 5500 ft., December, *Bolus*, 8185!; Natal, Tabanhllope, 6000 ft., October, *Wood*, 10659!; slopes of Drakensberg, 4–5000 ft., January, *Wood*, 3596!

DISTRIBUTION: Transvaal (Barberton, Belfast).

**H. squamosum**, Thunb.

Mountain slopes and plateau. 4–13 in. high, flowers yellow. February. *A. Dieterlen*, 250!; ravine on west slopes of plateau, bracts "old-gold" colour, common, *Phillips*, 624!; Eland's River, below the Mont-aux-Sources, c. 6000 ft., December, *Flanagan*, 1978! 8186!; Tsitsa Footpath, Drakensberg, 6500 ft., March, *Galpin*, 6680!

DISTRIBUTION: Humansdorp. Uitenhage. Albany. Tembuland. East Griqualand. Natal. Transvaal (Houtbosch).

SESUTO: *Hlohvana-Kholvana*. The rather large head.

**H. splendidum**, Less.

Slopes of high mountains, Potsane, Leribe District. 15–30 in. high, bracts bright yellow. Summer. *A. Dieterlen*, 760!; in the valley of the Eland's River, near the Mont-aux-Sources, 6000 ft., January, *Flanagan*, 1962!; Natal, Van Reenen, 5–6000 ft., November, *Wood*, 6155!; Tabanhllope, 6000 ft., *Wood*, 10541!; summit Drakensberg, near Luhana's Pass, 8600 ft., March, *Galpin*, 2324!

DISTRIBUTION: Murraysburg. Graaff Reinet. Somerset East. Molteno. East Griqualand. Transvaal (Barberton, Devil's Kantoor, Elandspruitbergen).

SESUTO: *Phefo ea Maloti*. [The wind of the high mountain. *Tōane-moru*. The "Tōane" of the forest.

**H. psilolepsis**, Harv.

Veld and mountain slopes. 8–22 in. high, bracts bright yellow. Summer–Autumn. *A. Dieterlen*, 173!; western slopes of Leribe plateau, *Phillips*, 691!; between Bethlehem and Bester's Vlei, c. 5000 ft., January, *Bolus*, 8184!; Cathkin Peak, 8350 ft., September, *West in Herb. Musei Austro-Afric.*, 4583!

DISTRIBUTION: Graaff Reinet. Komgha.

SESUTO: *Tōane-khomo*. The "Tōane" of the cattle. A decoction of the roots is used for curing painful menstruation. Shepherds weave hats with this plant.

**H. subglomeratum**, Less.

Doodman's Krans Mtn., 9650 ft., March, *Galpin*, 6683!

DISTRIBUTION: Graaff Reinet. Komgha.

**var. lingulatum**.

Veld, mountain slopes and plateau. 2½–20 in. high, bracts yellow. Autumn–Winter. *A. Dieterlen*, 151!

DISTRIBUTION: Albany. Graaff Reinet. King William's Town. Komgha.

SESUTO: *Thethebiyane*. *Thethebiloane*. Meanings unknown.

**H. latifolium**, Less.

Hollows and dongas on mountain slopes. 6–18 in. high, bracts dark yellow. Summer–Autumn. *A. Dieterlen*, 294!; Bester's Vlei, near Witzie's Hoek, 6000 ft., December, *Bolus*, 8188!; *Flanagan*, 1896!

DISTRIBUTION: Queenstown. Fort Beaufort. Komgha. Tembuland. East Griqualand. Natal. Transvaal (Devil's Kantoor, Barberton, Pietersburg, Houtbosch).

SESUTO: *Papetloane ea liliba*. The "papetloane" of the fountains. Used for "doctoring" people who wish some deed concealed and who are afraid of being found out.

var. *reticulatum*.

Veld and mountain slopes. 10-20 in. high, bracts brown. Summer-Autumn. *A. Dieterlen*, 56!

DISTRIBUTION: Transvaal (Houtbosch, Barberton).

SESUTO: *Papetloane e kholo*. The large flat spreading one. *Lebōkō*. Plumpness. Mixed with other plants it is made into a medicine used for colic. The roots are ground, and burnt near cattle suffering from "black leg."

*H. undatum*, Less, var. *pallidum*.

Veld and mountain slopes. 8-20 in. high, bracts yellow. Summer-Autumn. *A. Dieterlen*, 573!

DISTRIBUTION: Graaff Reinet. Stutterheim. Transkei.

SESUTO: *Bolebatsi*. Derived from the verb "ho lebala"—to forget. *Bolebatsi*. The act of forgetting. A native bathed with a decoction made from the roots believes that he becomes invisible, or forgotten by his enemies.

*H. alloides*, Harv.

Bester's Vlei, near Witzie's Hoek, 5500 ft., January, *Flanagan*, 2074!

DISTRIBUTION: Komgha. Transkei. East Griqualand. Natal. Transvaal (Barberton).

*H. leiopodium*, DC.

Veld and plateau. 8-25 in. high, bracts yellow. Summer-Autumn. *A. Dieterlen*, 52! 545!; Thaba Unchu, *Burke*.

DISTRIBUTION: George. Albany. Uitenhage. Bedford. Aliwal North. Natal. Orange Free State (Parys). Transvaal (Pretoria).

SESUTO: *Mohlomela-tsie oa thōta*. (545) "He of the valley" who threads the locusts. *Mohlomela-tsie oa thaba*. (52) "The mountainous one" who threads the locusts. The stems are used to thread locusts so that they can be easily roasted. A decoction prepared from the plant is given as an enema to children suffering with colic. *Dieterlen*, 545, grows in the open veld while No. 52 is found on the mountain slopes.

*H. cephaloideum*, DC.

Mountain slopes. 10-20 in. high, bracts bright yellow. Summer-Autumn. *A. Dieterlen*, 448!; Lefi's Kloof and southern slopes of

plateau, bracts golden yellow, frequent, *Phillips*, 657! 855!; Basutoland, without precise locality, *Cooper*, 753!

DISTRIBUTION: Albany. Queenstown. King William's Town. Tembuland. East Griqualand. Natal. Transvaal (Hoogeveldt).

SESUTO: *Mosuvane oa thaba*. The "Mosuvane" of the mountain.

### **H. appendiculatum**, Less.

Mountain slopes. 8-20 in. high, bracts white. Summer. Potsane, Leribe District. *A. Dieterlen*, 663!

DISTRIBUTION: Uitenhage. Albany. Murraysburg. Somerset East. Transkei. East Griqualand. Natal. Transvaal (Babaan Vlei).

SESUTO: *Senkotoana*. Meaning unknown.

### **H. Mundii**, Harv.

Near springs and damp spots on mountain slopes. 18-40 in. high, bracts whitish. Autumn. *A. Dieterlen*, 554!; western slopes of Leribe plateau, *Phillips*, 635!

DISTRIBUTION: Somerset East. East Griqualand. Natal. Swaziland. Transvaal (Pretoria, Waterberg).

SESUTO: *Phefo ea liliba*. The wind of the fountains. A decoction of the plant is used in chest complaints.

### **H. platypterum**, DC.

Mountain slopes, near rocks. 7-22 in. high, bracts dark yellow. Summer. *A. Dieterlen*, 423!; Lef's Kloof, *Phillips*, 870! Natal, Van Reenen, 5500 ft., March, *Schlechter*, 6972!

DISTRIBUTION: Somerset East. Transvaal (Barberton).

SESUTO: *Papetlvane ea mafika*. The flat, spreading one of the rocks. *Lesira*. A veil. *Leshella*. The spongy part of a bone. A decoction of the roots is said to renew the virility of men. The shepherd boys crush and suck the raw roots.

### **H. gymnocomum**, DC.

Mountain slopes. 15-30 in. high, bracts yellow, plant sweet smelling. Summer-Autumn. *A. Dieterlen*, 439!; western slopes of Leribe plateau, *Phillips*, 775!

DISTRIBUTION: Uitenhage. Albert. Transvaal (Devil's Kantoort).

SESUTO: *Phefo ea settlo*. The wind of the ointment. Used to fumigate sick rooms. On account of the pleasant smell it is mixed with fat and used as an ointment. In former times only the wives of the chiefs were allowed to anoint themselves with it.



**H. trilineatum**, DC.

Wet sandy places near rivulets, at the summit of the Mont-aux-Sources, c. 8700 ft., January, shrubby plant, 1–2 ft. high, *Thode*, 24!; summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1974!; Giant's Castle, 7500 ft., November, *A. Bolus in Herb. Guthrie*, 4831!; Wittebergen, *Drège*.

DISTRIBUTION: Graaff Reinet.

var. **tomentosum**, Harv.

Basutoland, without precise locality, *Cooper*, 714; wet sandy places near rivulets, at the summit of the Mont-aux-Sources, c. 8700 ft., January, a shrub 2–3 ft. high, used for fuel, *Thode*, 25!; Doodman's Krans Mtn., 8600–9500 ft., March, *Galpin*, 6690! 6691!; Wittebergen, 6–8000 ft., *Drège*; summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1973! 1975!, *Mann in Herb. Marloth*, 2872! *A. Bolus in Herb. Guthrie*, 8436!

DISTRIBUTION: Endemic.

## var.

Stony places in the Caledon Range (spurs of Drakensberg), c. 6900 ft., February. A shrub, 2–3 ft. high, *Thode*, 26!

DISTRIBUTION: Endemic.

**H. cymosum**, Less.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1970!

DISTRIBUTION: Cape. Albany. Transkei. Natal.

**H. simillimum**, DC.

Mountain slopes. 8–22 in. high, bracts yellow. Summer–Autumn. *A. Dieterlen*, 275!; banks of stream on western slopes of plateau, *Phillips*, 710!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1923!; Eland's River Valley, near the Mont-aux-Sources, 5800 ft., December, *Flanagan*, 1976!

DISTRIBUTION: Stockenström. Komgha. Transkei. Tembuland. East Griqualand. Natal (Charlestown, 5–6000 ft.).

SESUTO: *Pulungoana*. A small gun.

**H. callicomum**, Harv.

Veld and mountain slopes. 8–22 in. high, bracts light yellow. Autumn. *A. Dieterlen*, 126!; Basutoland, without precise locality, *Cooper*, 730!

DISTRIBUTION: Stutterheim. East Griqualand. Tembuland. Natal. Zululand.

**SESUTO:** *Motoantoanyane*. The despicable thing. See note under *Aster hispidus* and *Helichrysum rugulosum*. Used for fuel in winter when wood is scarce.

**H. aureo-nitens**, Sch. Bip.

Veld, mountain slopes and plateau. 4–13 in. high, bracts yellow. Summer-Autumn. *A. Dieterlen*, 143!; mountain slopes above the Mission Station, bracts white or yellow, common, *Phillips*, 521!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1924!; Mont-aux-Sources, 9500 ft., October, *A. Bolus in Herb. Guthrie*, 4835!; Eland's River Valley under the Mont-aux-Sources, 5500 ft., January, *Flanagan in Herb. Bolus*, 8183!

**DISTRIBUTION:** Murraysburg. Aliwal North. Tembuland. East Griqualand. Natal. Transvaal (Belfast, Wonderfontein, Johannesburg).

**SESUTO:** *Tōane-poli*. The "Tōane" of the goat. *Tōane-ntja*. The "Tōane" of the dog. A stock of this plant is always found in a Basuto hut, it being used as tinder to start a fire. The natives also carry live embers home between some branches and so start a fire of their own. A decoction is given to children in the habit of "wetting" their beds. Shepherds weave hats with this plant.

**H. rugulosum**, Less.

Veld and mountain slopes. 5–12 in. high, bracts white, pink and yellow. Summer-Autumn. *A. Dieterlen*, 255!; common round Leribe plateau, a small shrub 9–18 in. high, growing in large patches, *Phillips*, 521! 672! 701!

**DISTRIBUTION:** Riversdale. Graaff Reinet. Somerset East. Aliwal North. King William's Town. Natal. Transvaal (Elandspruitbergen, Rustenberg, Pretoria).

**SESUTO:** *Motvantvanyane o monyenyane*. The small despicable thing. Together with *H. callicomum*, Harv., and *Aster hispidus*, Bkr., it is used as a protective charm. In cases of colds in children, the plant is used to fumigate the hut.

**H. dregeanum**, Sond. & Harv.

Mountain slopes and plateau. 3–12 in. high, bracts dark yellow. Summer-Autumn. *A. Dieterlen*, 567!; Veld, near Peka, Leribe District, *A. Dieterlen*, 567b!; Wittebergen, *Cooper*, 617.

**DISTRIBUTION:** Aliwal North. Orange Free State (Bloemfontein). Transvaal (Potchefstroom).

**SESUTO:** *Tōane ea thaba*. The "Tōane" of the mountain. The leaves are smoked to cure a cold in the head.

**H. album**, N. E. Br.

Wet rocks on the summit of Mont-aux-Sources, 9000 ft., January, *Thode*, 29!; summit Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1972!; Natal, Bushman's River Pass, Drakensberg, 7-8000 ft., *Evans*, 48.

DISTRIBUTION: Endemic.

**H. agrostophilum**, Klatt.

Mountain slopes. 8-20 in. high, bracts light yellow. Autumn. *A. Dieterlen*, 827!; Bester's Vlei, near Witzi's Hoek, 6500 ft., December, *Bolus*, 8189!

DISTRIBUTION: Transvaal (near Belfast, Barberton, Elandspruitbergen, Pietersburg).

SESUTO: *Papetloana ea thaba*. The flat, spreading one of the mountain. Together with other plants a preventive "charm" against all illnesses is prepared from this species. Burnt in winter as fuel.

**H. alticolum**, Bolus, var. **montanum**.

Summit of the Mont-aux-Sources, 9-11,000 ft., October, *A. Bolus in Herb. Bolus*, 10682!; *Mann in Herb. Marloth*, 2866!; *Evans*, 742!

DISTRIBUTION: Endemic.

**H. athrxiifolium**, O. Hoffm.

Leribe plateau. 5-12 in. high, bracts yellow. January. *A. Dieterlen*, 502! 902!; near Harrismith, 4-5000 ft., February, *Wood*, 4791!

DISTRIBUTION: Natal (Colenso).

SESUTO: *Motvantvanyane o monyenyane*. The small despicable thing. The leaves are smoked for chest complaints.

**H. calocephalum**, Schltr. (Pl. VI, fig. i.)

Mountain slopes, Mathokvane, Leribe District. 4-10 in. high, bracts pink or white. December, *A. Dieterlen*, 803!; Mont-aux-Sources, 7000 ft., December, *Bolus*! *A. Bolus in Herb. Guthrie*, 4828!; 9500 ft., January, *Flanagan*, 1967!

DISTRIBUTION: Somerset East. East Griqualand. Natal.

SESUTO: *Tōane-Balingvana e Kholo*. The big "Tōane" of the small ancestors. A decoction of the roots is used to cure diarrhoea in children.

**H. confertum**, N. E. Br.

Bushman's River Pass, 7-8000 ft., July, *Evans*, 49!

DISTRIBUTION: Endemic.

**H. dasycephalum**, O. Hoffm.

Mountain slopes and plateau. 6-20 in. high, bracts yellow. Autumn. *A. Dieterlen*, 80!; Qoqolosi Peak and on sloping rock ravine on west slopes of plateau, *Phillips*, 735! 929!; Natal, Van Reenen's Pass, *Krook*, 1437!

DISTRIBUTION: Endemic.

SESUTO: *Mogabola*. He who causes to laugh. *Senkotoana*. Meaning unknown. Used as fuel.

**H. epapposum**, Bolus, var. **robustum**, Bolus.

Tsitsa Footpath, Drakensberg, 7500 ft., March, *Galpin*, 6681!; Drakensberg, near Luhana Pass, 8500 ft., March, *Galpin*, 2325!

DISTRIBUTION: Endemic.

**H. Flanaganii**, Bolus.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1964!; Doodman's Krans Mtn., 9600 ft., March, *Galpin*, 6682!

DISTRIBUTION: Endemic.

**H. fulvum**, N. E. Br.

Natal, Drakensberg, 5-6000 ft., *Evans*, 352!; Van Reenen, *Wood*, 4533.

DISTRIBUTION: Endemic.

**H. glomeratum**, Klatt.

Plains, Antelope Park, 5900 ft., March, *Galpin*, 6684!; Natal, grassy hill at Polela, 5-6000 ft., *Wood*, 4588!

DISTRIBUTION: East Griqualand. Tembuland. Natal.

**H. Haygarthii**, Bolus.

Natal, Van Reenen, 5-6000 ft., February, *Wood*, 9727.

DISTRIBUTION: Endemic.

**H. infaustum**, Wood & Evans.

Mountain slopes. 10-30 in. high, bracts yellow. March. *A. Dieterlen*, 708! 708b!; grassy summit of the Mont-aux-Sources, c. 8850 ft., January, *Thode*, 27!; Eland's River, near the Mont-aux-Sources, 6000 ft., December, *Flanagan*, 1977!; Van Reenen, March, *Wood*, 5973, 6973!

DISTRIBUTION: Endemic.

SESUTO: *Motoantoanyane oa matlapa*. The despicable thing of the flat stones. *Mpulutsoana*. The small grey one. Used as fuel.

**H. lineatum**, Bolus.

Doodman's Krans Mtn., 9000 ft., March, *Galpin*, 6669!

DISTRIBUTION: Endemic.

**H. nanum**, Klatt.

Natal, Drakensberg, March, *Haygarth* (Wood, 5698); Mawahqua, 6-7000 ft., January, *Wood*, 4593!

DISTRIBUTION: East Griqualand.

**H. oreophilum**, Klatt.

Natal, Oliver's Hoek Pass, 5000 ft., January, *Wood*, 3596.

DISTRIBUTION: Endemic.

**H. pulvinatum**, O. Hoffm.

Natal, Van Reenen, 5-6000 ft., *O. Kuntze*.

DISTRIBUTION: Endemic.

**H. plantaginifolium**, O. Hoffm.

Bester's Vlei, near Witzie's Hoek, 5400 ft., January, *Bolus*, 8187!

DISTRIBUTION: Komgha. Tembuland. Transvaal (Wonderfontein, Carolina, Pretoria).

**H. Randii**, Sp. Moore. (Pl. VI, fig. 2.)

Veld and banks of Caledon River. 5-10 in. high, bracts white. *A. Dieterlen*, 857!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8181!, *Flanagan*, 1920!; summit Mont-aux-Sources, 8-10,000 ft., October, bracts white, *A. Bolus in Herb. Bolus*, 6864!; Natal, Tugela Falls, 4-5000 ft., January, *Wood*, 3606!

DISTRIBUTION: Molteno. Aliwal North. Tembuland. East Griqualand. Transvaal (Pretoria, Barberton, Carolina).

SESUTO: *Senkotoana*. Meaning unknown.

**H. retortoides**, N. E. Br.

Rocky places on the summit of the Mount-aux-Sources, c. 8850 ft., January, *Thode*, 28!, 9300-9500 ft., October, *Mann in Herb. Marloth*, 2874!, *A. Bolus in Herb. Guthrie*, 4530!; Natal, Drakensberg, 6-7000 ft., November, *Wilson* (Wood, 8265).

DISTRIBUTION: Endemic.

**H. setigerum**, Bolus.

Doodman's Krans Mtn., Ben McDhui, etc. 9550-9900 ft., March, *Galpin*, 6670, 6676!; summit Mount-aux-Sources, 9500 ft., January, *Flanagan*, 1969!

DISTRIBUTION: Endemic.

var. **minor**.

Doodman's Krans Mtn., 9650 ft., March, *Galpin*, 6686; Van Reenen, 5500 ft., January, *Wood*, 10771!

DISTRIBUTION: Endemic.



**H. witbergense**, Bolus.

Ben McDhui, 9600 ft., March, shrub 2 ft. high, *Galpin*, 6692!

DISTRIBUTION: Endemic.

**H. sp.** (near *H. marginatum*, DC.)

Doodman's Krans Mtn. and Ben McDhui, 9500–9900, March, *Galpin*, 6677.

**H. sp.** (cf. *H. cephaloideum*, DC., and *H. campaneum*, Sp. Moore.)

Doodman's Krans Mtn., 9650 ft., March, *Galpin*, 6685.

**H. sp.** (*Xerochlaena*.)

Natal, Van Reenen, 5–6000 ft., February, *Haygarth* (*Wood*, 9620).

**H. sp.** (*Xerochlaena*.)

Natal, Mahwaqua, 6–7000 ft., April, *Wood*, 4557.

**H. sp.** (*Declivata*.)

Natal, Polela, 5–6000 ft., July, *Evans*, 516.

LEONTONYX, *Cass.*

**L. squarrosus**, DC.

Mountain slopes. 2–10 in high, flowers yellowish. Spring. *A. Dieterlen*, 648!

DISTRIBUTION: Piquetberg. Cape. Oudtshoorn. Uitenhage. Komagh. Transkei. Pondoland. East Griqualand. Natal.

SESUTO: *Mosuoane*. The one on whom skins are made supple. *Tōane ea metsi*. The “Toane” of the water or of dampness.

**L. spathulatus**, Less.

Satsanna's Peak, Drakensberg, 9400 ft., March, *Galpin*, 6671!

DISTRIBUTION: Cape. Riversdale. Knysna. Graaff Reinet.

PETALACTELLA, *N. E. Br.*

**P. Woodii**, *N. E. Br.*

Rocky hills, near Harrismith, 5–6000 ft., December, *Wood*, 5139!; Natal, rocky hills, Drakensberg, February, *Wood*, 4813.

DISTRIBUTION: Endemic.

STOEBE, *Linn.*

**S. cinerea**, Thunb.

Mountain slopes. Bush, 20–30 in high, bracts golden yellow. May. *A. Dieterlen*, 885!

DISTRIBUTION: Cape. Paarl. Port Elizabeth. Tembuland. Natal. Transvaal (Waterberg).

SESUTO : *Sehalahala sa lengope*. The bush of the river bank. Used as fuel in winter.

#### METALASIA, Br.

##### **M. muricata**, Less.

Mountain slopes. 15–35 in. high, bracts white. Autumn. A. Dieterlen, 257!; Basutoland, without precise locality. Bush 2–3 ft. high, bracts white, Cooper, 704!; Natal, Drakensberg, Polela, 6–7000 ft., Evans, 542!

DISTRIBUTION : Cape. Port Elizabeth. Albany. Prince Albert. East Griqualand.

SESUTO : *Lehlohlo*. He who packs (tightly) corn in a basket. *Sehalahala se seputsoa*. The grey bush. Together with *Eriocephalus punctulatus* used to fumigate a hut during illness or after a death. Used as fuel.

#### NESTLERA, Spreng.

##### **N. virgata**, N. E. Br.

Natal, Bushman's River Pass, July, Evans, 50; among grass, sources of the Bushman's River, Drakensberg, June, Evans, 643!

DISTRIBUTION : Endemic.

##### **N. acerosa**, Harv. (*ex descr.*)

Slopes and plateau of Thaba Phatosa, Leribe District. 10–22 in. high, flowers bright yellow. Winter–Spring (July, 1908), A. Dieterlen, 615! 616!; Basutoland Mtns., near Mequeathing, Cooper, 733.

DISTRIBUTION : Barkly East. Albert.

SESUTO : *Moholu oa pela*. *Moholu a lekhoaba*.

#### RELHANIA, L'Her.

##### **R. pungens**, L'Her.

Summit Pot River Berg, 5900 ft., March, Galpin, 6693!

DISTRIBUTION : Riversdale. Port Elizabeth. Mossel Bay. Albany. Tembuland. Natal.

#### MACOWANIA, Oliv.

##### **M. glandulosa**, N. E. Br.

Summit of the Mont-aux-Sources, 9500 ft., January, F'lanagan, 1879!; Natal, Taban'holope, April, Evans, 412, same locality, 6000 ft., October, Wood, 10629!

DISTRIBUTION : Endemic.

##### **M. pulvinaris**, N. E. Br.

Doodman's Krans Mtn., 9650 ft., March, Galpin, 6694!

DISTRIBUTION : Queenstown.

ATHRIXIA, Ker.

**A. elata**, Sond.

Mountain slopes and plateau. Flowers yellow and mauve. November. *A. Dieterlen*, 236! 926!; Basutoland, without precise locality, *Cooper*, 735!; Natal, Giant's Castle, 5000 ft., *Sim*.

DISTRIBUTION: Transvaal (Magaliesberg).

SESUTO: *Phefshoana ea Basiea*. The small wind of the "Basiea." As a cure for sore feet the Basutos use the plant in the following manner: The patient places his feet, in which incisions have been made, over a hole made in the ground; they are then washed with a decoction prepared from the leaves and roots. The blood from the incisions must fall into the hole, which is afterwards filled with earth. Also used to brew a kind of tea.

**A. angustissima**, DC.

Slopes of high mountains at Potsane, Leribe District. 6-15 in. high, rays white. Summer. *A. Dieterlen*, 676!; "Cave," Eland's River Valley, at the foot of Mont-aux-Sources, 6800 ft., January, *Flanagan*, 1943!; Albertina, south of Harrismith, 5-6000 ft., February, *Wood*, 9726!; Natal, Drakensberg, 5-6000 ft., February, *Wood*, 9726; Doodman's Krans Mtn. and Ben McDhui, 8800-9500 ft., March, *Galpin*, 6696!; Wittebergen, 6-7000 ft., *Drège*!

DISTRIBUTION: Tembuland.

SESUTO: *Phefshoana e nyenyane*. The small wind. See note under *A. elata*.

**A. arachnoidea**, Wood & Evans.

Natal, Polela, 6000 ft., *Evans*, 613.

DISTRIBUTION: Endemic.

**A. fontana**, Macow. (Pl. I. fig. B).

Doodman's Krans Mtn. and Tsitsa Footpath, 8000-8800 ft., March, *Galpin*, 6695! 6701; Summit, Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1952!

DISTRIBUTION: Somerset East. Tembuland. East Griqualand. Natal.

**A. pinifolia**, N. E. Br.

Natal, Bushman's Caves, Drakensberg, 6000 ft., July, *Evans*, 59; Bed of stream, Polela, 6-7000 ft., July, rays white or pink, disc yellow, *Evans*, 581!; Mont-aux-Sources, c. 6000 ft., October, *A. Bolus in Herb. Bolus*, 6880!

DISTRIBUTION: Endemic.

## BOJERIA, DC.

**B. nutans**, Bolus.

Basutoland, river banks above Buffalo River Waterfall, 8100 ft., March. An erect virgate shrub, 5 ft. high, *Galpin*, 6659!; grassy slopes near the summit of Mapedi's Peak, Witzie's Hoek, c. 7980 ft., February. A clammy scented plant, with greenish heads, *Thode*, 21!

DISTRIBUTION: Endemic.

## PRINTZIA, Cass.

**P. pyrifolia**, Less.

Mountain slopes. Bush 4-8 ft. high, flowers white. Early Spring and Winter. *A. Dieterlen*, 13!; Basutoland, without precise locality, *Cooper*, 691!; Orange Free State, Witteberg, *Rehmann*, 3969!

DISTRIBUTION: Somerset East. Komgha. Tembuland. East Griqualand.

SESUTO: *Sephōmōlo*. Derived from the verb "ho phōmōlo"—to rest. *Lekhisa*. A long hair. A preparation made from the plant is given as an enema for internal tumours. Used as fuel.

**P. asteroides**, Schltr.

Natal, Ixopo, 4-5000 ft., January, *Evans*, 625.

DISTRIBUTION: Endemic.

**P. laxa**, N. E. Br.

Natal, Drakensberg, July, *Evans*, 53.

DISTRIBUTION: Endemic.

## GEIGERIA, Griseb.

**G. passerinoides**, Harv.

Veld. Flowers yellow. April. Peka, Leribe District, *A. Dieterlen*, 991!; Wilge River, Harrismith, 5-6000 ft., June, *Wood*, 4784!

DISTRIBUTION: S.W. Africa: Murraysburg. Griqualand West. Natal. Zululand. Orange Free State (Bloemfontein). Transvaal (Bloemhof).

SESUTO: *Hlohoana-Khologoanyane*. Rather big heads. In Autumn it is burnt in cultivated lands to hasten the ripening of the grain. The illness of a child is sometimes supposed to be due to "insects" or "worms" in the head, in which case incisions are made on the child's forehead, cheeks, and nape of the neck, and a drug prepared from the plant is rubbed in and it is believed that the "insects" are driven away through the intestines.

XANTHIUM, *Linn.*

**X. spinosum**, *Linn.*

Veld and slopes round villages. 6–30 in. high. Summer–Autumn.

*A. Dieterlen*, 312!

DISTRIBUTION: An introduced weed found in most parts of South Africa.

SESUTO: *Mokōala*. Syphilis (in the early stage). *Sehlabahlabane*. He who pricks. Said to have been introduced into Basutoland by the cattle taken as loot during the war with the Zulu chief Lakalebalele in 1873.

ZINNIA, *Linn.*

**Z. multiflora**, *Linn.*

Veld and mountain slopes. 4–25 in. high, flowers red. Summer–Autumn. *A. Dieterlen*, 156!; bush, 3–4 ft. high, flowers brick-red, common, *Phillips*, 535!

DISTRIBUTION: Komgha. Natal.

SESUTO: *Lipii*. Trumpets. *Lipii-pii*. Many trumpets. The flower-heads make playthings for the native children.

BIDENS, *Linn.*

**B. pilosa**, *Linn.*

Mountain slopes and waste places. 8–36 in. high, flowers yellow. Summer. *A. Dieterlen*, 86a!

DISTRIBUTION: George. Komgha. Natal.

SESUTO: *Moonyane*. Meaning unknown.

**B. leucantha**, *Willd.*

Banks of water courses on mountain slopes. 6–15 in. high, flowers yellow. March–May. *A. Dieterlen*, 86b!

DISTRIBUTION: An imported weed.

SESUTO: *Moonyane*. Meaning unknown.

ERIOCEPHALUS, *Linn.*

**E. punctulatus**, *DC.*

Mountain slopes and plateau. A bush, 2–4 ft. high, flowers white. Autumn. *A. Dieterlen*, 435!; Basutoland, without precise locality, *Cooper*, 692! 744!

DISTRIBUTION: Namaqualand Minor. Aliwal North.

SESUTO: *Sehalahala sa matlaka*. The bush of the vultures. It is said to grow near places where the vultures roost. It is used together with *Metalasia muricata* to fumigate the hut of a person suffering with a cold or diarrhoea.



**E. eximius**, DC.

Basutoland, rocky ridges above the Buffalo River Waterfall, c. 7780 ft., March, *Galpin*, 6697!

DISTRIBUTION: Graaff Reinet.

LASIOSPERMUM, *Lag.***L. radiatum**, Trev.

Mountain slopes. 6–18 in. high, rays white. Summer. *A. Dieterlen*, 16!

DISTRIBUTION: Albany. Murraysburg. Graaff Reinet. Aliwal North. Komgha. Transvaal (Vereeniging).

SESUTO: *Sehalikane se seholo*. The large roasted one. The plant has a pleasant smell and is mixed with fat to make an ointment. Used also to fumigate a sick-room.

ATHANASIA, *Linn.***A. punctata**, Harv.

Margin of Pot River Berg Forest, 5500 ft., March, *Galpin*, 6698.

DISTRIBUTION: Natal.

**A. linifolia**, Harv., *forma*.

Mountain slopes, Malaoaneng, Leribe District. 15–35 in. high flowers yellow. Summer–Autumn. *A. Dieterlen*, 881! 882!

DISTRIBUTION: Endemic.

SESUTO: *Lelingvana*. The small cannibal.

The leaf buds have gone into the knobby, tomentose, winter state. This woolliness disappears after spring as the inflorescence develops.

**A. montana**, Wood & Evans.

Natal, sources of the Bushman's River, 6–7000 ft., June, flowers yellow, *Evans*, 662!

DISTRIBUTION: Endemic.

**A. Thodei**, Bolus.

Stony places near the summit of the Mont-aux-Sources, c. 8400 ft., January, a plant 4–5 ft. high, clammy and strongly scented, *Thode*, 23!; Doodman's Krans Mtn., 9200 ft., March, *Galpin*, 6707!

DISTRIBUTION: Endemic.

EUMORPHIA, *DC.***E. sericea**, Wood & Evans.

Natal, Bushman's River Pass, 8–10,000 ft., April, *Evans*, 715; stony places, Doodman's Krans, 9650 ft., March, prostrate, *Galpin*,

6700!, 8640 ft., shrubs 3-4 ft., *Galpin*, 6699!; summit Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1959! stony places on Mont-aux-Sources, c. 8850 ft., January, shrubby, rays white, *Thode*, 20!

DISTRIBUTION: Endemic.

COTULA, *Linn.*

**C. bipinnata**, Thunb.

In marsh at base of Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6702!

DISTRIBUTION: Namaqualand Minor. Malmesbury. Wellington. Riversdale. Ceres.

**C. anthemoides**, Linn.

Damp spots on plateau.  $1\frac{1}{2}$ -6 in. high, flowers greenish-yellow. Autumn. Cana, Tejatejaneng District. *A. Dieterlen*, 328!

DISTRIBUTION: Uitenhage. Komgha Transkei. Natal. Transvaal (Pretoria). Lourenco Marques.

SESUTO: *Hlapi e nyenyane*. The small fish. A decoction prepared from the leaves and roots is drunk for colic.

**C. sp.** = Schlechter, 3390.

Bester's Vlei, near Witzie's Hoek, December, *Bolus*!

DISTRIBUTION: Natal.

**C. sp.**

In marsh at base of Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6703.

CENIA, *Juss.*

**C. hispida**, Bth. & Hk.

Mountain slopes and plateau. 3-15 in. high, flowers yellow. Summer. *A. Dieterlen*, 614!; damp spots in ravines, *Phillips*, 772! 867!; Witzie's Hoek, c. 6600 ft., February, *Thode*!; summit of the Mont-aux-Sources, January, *Flanagan*, 2310!; Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6704!

DISTRIBUTION: Stutterheim. Komgha. Tembuland. East Griqualand. Natal. Transvaal (Oliphant's River).

SESUTO: *Motoantoanyane oa thaba*. The despicable thing of the mountain. *Mokubetso*. Fumigation. A decoction made from the roots is drunk in cases of nausea. In summer the plant is burnt in the fields to increase the crops.

SCHISTOSTEPHIUM, *Less.*

**S. crataegifolium**, Fenzl.

Mountain slopes. 7-20 in. high, flowers yellow. Autumn.

*A. Dieterlen*, 289!; Natal, Drakensberg, *Wood*; Van Reenen, 5500 ft., March, *Schlechter*, 6974!

DISTRIBUTION: Uitenhage. Albany. Komgha. Transkei. Tembuland. East Griqualand. Natal. Bechuanaland. Transvaal (Pietersburg, Crocodile and Magalies Rivers).

SESUTO: *Leapi*. *Lehakanya*. Meanings unknown. *Kobokholo*. The big coat. *Kobo-tsa-marena*. The coats of the chiefs. The leaves are smoked for chest complaints. A lotion is prepared from the roots for bathing sore eyes.

#### GYMNOPENTZIA, *Benth.*

**G. pilfera**, N. E. Br.

Natal, Bushman's Caves, Drakensberg, 6-7000 ft., July, *Evans*, 51; Source of the Injasuti, 7-8000 ft., June, flowers yellow, *Evans*, 640!

DISTRIBUTION: Endemic.

#### PENTZIA, *Thunb.*

**P. Cooperi**, Harv.

Mountain slopes at Malavaneng, Leribe District, 25-40 in. high, flowers yellow. Autumn. *A. Dieterlen*, 666!; Natal, below the Montaux-Sources, 9-10,000 ft., *Evans*, 754! Basutoland, banks of streamlets above the Buffalo River Waterfall, c. 8200 ft., March, *Galpin*, 6705!; Doodman's Krans, 8640 ft., March, *Galpin*, 6706!; Basutoland, without precise locality, *Cooper*, 711!

DISTRIBUTION: Graaff Reinet. Albert.

SESUTO: *Napshane*.

**P. virgata**, Less.

Mountain slopes. A bush 12 in. high, flowers yellow. January-April. *A. Dieterlen*, 844!

DISTRIBUTION: Bushmanland. Swellendam. Worcester. Uitenhage. Beaufort West. Middleburg. Komgha. Zululand. Griqualand West. Bechuanaland. Transvaal (Sandloop).

SESUTO: *Mohantsöane*. Meaning unknown.

#### ARTEMISIA, *Linn.*

**A. afra**, Jacq.

Damp and shady spots on mountain. 15-40 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 96!

DISTRIBUTION: Aliwal North. Natal. Transvaal (Lydenburg).

SESUTO: *Lengana*. Meaning unknown. Children suffering with constipation are given a decoction of the plant as an enema. A lotion for washing the body is also prepared from it.

CINERARIA, Linn.

**C. aspera**, Thunb.

Stony spots on mountain slopes. 10–40 in. high, flowers yellow. Autumn–Winter. *A. Dieterlen*, 125!; in kloof near Rhodes, 6200 ft., March, *Galpin*, 2331!

DISTRIBUTION: Murraysburg. Graaff Reinet. Middleburg. Molteno. Aliwal North.

SESUTO: *Moholu oapela*. The stomach of the rock-rabbits. The natives say rock-rabbits are fond of this plant. The leaves are smoked to relieve asthma and tuberculosis. It is said to be as intoxicating as “dagga” (*Cannabis indica*).

**C. erodioides**, DC.

Doodman’s Krans Mtn., 9650 ft., March, *Galpin*, 6713.

DISTRIBUTION: Uitenhage.

This name was given by Kew to Mr. Galpin.

**C. lobata**, L’Her.

Doodman’s Krans Mtn., 9100 ft., March, *Galpin*, 6710!; Natal, De Beer’s Pass, 5–6000 ft., March, *Wood*, 5191!

DISTRIBUTION: Calvinia. Ceres. Worcester. Somerset East. Transkei. East Griqualand.

**C. lyrata**, DC.

Veld and mountain slopes. 8–20 in. high, flowers yellow. Spring Autumn. *A. Dieterlen*, 93!; mountain slopes above the Mission Station, not common, *Phillips*, 510!; Bester’s Vlei, near Witzie’s Hoek, 5400 ft., December, *Bolus*, 8192!; Tsitsa Footpath, Drakensberg, 7850 ft., March, *Galpin*, 6711; between Tent Kop and Antelope Park, 5600 ft., March, *Galpin*, 6708!

DISTRIBUTION: Aliwal North. Natal. Transvaal (Standerton).

SESUTO: *Khōtōliea*. Meaning unknown. See note under *Senecio-rhynchlaenus*, DC.

**C. albicans**, N. E. Br.

Natal, Polela, April, *Fourcade* (*Wood*, 1895!).

DISTRIBUTION: Zululand.

**C. Dieterlenii**, Phillips, sp. nov. *Planta* herbacea, 12–28 poll. alta. *Ramuli* juniores albo-lanati, demum glabri. *Folia* petiolata, 2·5–7 cm. longa. *Petiolus* 1–2·5 cm. longus, sulcatus, mox glaber, basi auricularis; lamina 1–4·5 cm. longa, 1–5·5 cm. lata, cordata, pinnati-lobata, glabra; juniores albo-lanata. *Inflorescentia* terminales vel axillares; capitula in laxa panícula vel racemo disposita. *Capitulum*

6-8 mm. longum, circiter 9 mm. latum, obovatum. *Bracteae* involucae circiter 8, 4.5 mm. longae, 1 mm. latae, oblongae, acuminatae, apice acutae, glabrae, marginatae. *Corolla* radii 6 mm. longa; tubus 2 mm. longus, cylindricus, glaber; limbus 4 mm. longus, 2 mm. latus, oblongus vel elliptico-oblongus, apice minute tridentatus. *Ovarium* 1.3 mm. longum, obovato-oblongum, paullo compressum, glabrum, marginatum; stylus 3 mm. longus; lobi .75 mm. longi, lineares. *Tubus* floris disci 4 mm. longus, cylindricus, glaber; lobi .5 mm. longi, oblongi vel ovato-oblongi, apice obtusi. *Filamenta* 1 mm. longa, supra paullo inflata; antherae 1.5 mm. longae, lineares, apice glandulosae. *Pappus* 3 mm. longus, scabridus. *Ovarium* 2 mm. longum, .75 mm. latum, obovato-oblongum, compressum, glabrum, marginatum; stylus 4.5 mm. longus, glaber; lobi .75 mm. longi, truncati.

Plateau and mountain slopes. Flowers yellow. Autumn. *A. Dieterlen*, 576.

DISTRIBUTION: Endemic.

SESUTO: *Khõtōliea e Kholo*. The big "Khõtōliea." *Moholu oa pela*. The stomach of the rock-rabbit.

A sub-herbaceous plant 12-28 in. high. Young branchlets white-woolly becoming glabrous or nearly so. *Leaves* petioled, 2.5-7 cm. long; petiole 1-2.5 cm. long, furrowed, eared at the base, usually glabrous; lamina 1-4.5 cm. long, 1-5.5 cm. broad, cordate in outline, palmately lobed, glabrous, or the youngest leaves white-woolly. *Inflorescence* terminal or axillary; the capitula arranged in a loose panicle or raceme. *Heads* 6-8 mm. long, about 9 mm. in diameter, ovate in outline. *Involucral bracts* about 8, 4.5 mm. long, 1 mm. broad, oblong, acuminate, acute, glabrous, with membranous margins. *Ray-florets* female; corolla tube 2 mm. long, cylindric, glabrous; limb 4 mm. long, 2 mm. broad, oblong or elliptic-oblong, faintly 3-toothed at the apex, 4-nerved. *Ovary* 1.3 mm. long, obovate-oblong in outline, slightly compressed, glabrous, with a narrow membranous marginal wing; style 3 mm. long; lobes .75 mm. long, linear. *Disc-florets* hermaphrodite. *Corolla-tube* 4 mm. long, cylindric, 5-nerved, glabrous; lobes .5 mm. long, oblong or ovate-oblong, obtuse. *Stamens* inserted about half-way down the corolla tube; filaments 1 mm. long, slightly swollen above; anthers 1.5 mm. long, linear, divided at the base, with an ovate-oblong gland .3 mm. long at the apex. *Pappus* 3 mm. long, rough. *Ovary* 2 mm. long, .75 mm. broad, obovate-oblong in outline, compressed, glabrous, with a narrow membranous marginal wing; style 4.5 mm. long, glabrous; lobes .75 mm. long, linear, truncate.

Allied to *C. geifolia*, Linn., but differs in having perfectly glabrous leaves and the achenes without marginal cilia.



**C. montana**, Bolus.

Natal, Bushman's River Valley, 6-8000 ft., October, flowers yellow, *Wood*, 10562!; summit Drakensberg, 5-6000 ft., February, *Wood*, 9925!

DISTRIBUTION: Endemic.

SENECIO, *Linn.*

**S. vulgaris**, Linn.

Garden of Mission Station, flowers yellow. Summer. *A. Dieterlen*, 895!

DISTRIBUTION: Cosmopolitan.

SESUTO: *Moholu oa pela o monyenyane*. The small stomach of the rock-rabbit.

**S. macrocephalus**, DC., var. *hirsutissimus*.

Mountain slopes at Malavaneng, Leribe District. Flowers magenta. December. *A. Dieterlen*, 930!; Natal, Giant's Castle, 8000 ft., November, flowers red, *A. Bolus in Herb. Guthrie*.

DISTRIBUTION: King William's Town. Komgha. Transkei.

SESUTO: *Se-bea-mollo*. It burns. *Ngoakoane ea lōti*. The "Ngoakoane" (a young brother or sister of a dead child) of the high mountains. A medicine for colic is prepared from it.

**S. concolor**, DC.

Natal, Tabanhlope, 6000 ft., October, flowers purple, *Wood*, 10478!

DISTRIBUTION: Cape. East Griqualand. Transvaal (Belfast). This is probably the same as *S. speciosus*, Willd.

**S. concolor**, DC., *forma*.

Natal, near Polela, 4-5000 ft., April, flowers red, *Wood*, 4548.

DISTRIBUTION: Endemic.

**S. erubescens**, DC.

Veld and mountain slopes. 6-25 in. high, rays violet. Summer. *A. Dieterlen*, 281! 640!; ravines, rays blue, *Phillips*, 764! 773!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8199!

DISTRIBUTION: Cape. Humansdorp. Port Elizabeth. Stutterheim. Aliwal North. Komgha. Tembuland. East Griqualand. Natal.

SESUTO: *Letapiso*. The diminisher of strength. The natives mix the crushed plant with tobacco to make the latter milder. A decoction of the roots is drunk for nausea and rheumatic fever.

**S. barbatus**, DC.

Summit of the Mount-aux-Sources, 9500 ft., January, *Flanagan*, 1954!

DISTRIBUTION: Natal. East Griqualand.

**S. thyrsoides**, DC.

Natal, Van Reenen, 5-6000 ft., November, *Wood*, 4777; Satsanna's Peak, Drakensberg, 9000 ft., March, flowers blue, *Galpin*, 6717!

DISTRIBUTION: Stutterheim.

**S. Sandersoni**, Harv.

Orange Free State, near Harrismith, *Wood*, 4807.

DISTRIBUTION: East Griqualand.

**S. asperulus**, DC.

Mountain slopes and plateau. 6-22 in. high, flowers yellow. Spring-Summer-Autumn. *A. Dieterlen*, 61! 580!; Lefi's Kloof and south slopes of plateau, rays yellow, *Phillips*, 811! 861!

DISTRIBUTION: Between Albany and Somerset East. Graaff Reinet. Burghersdorp. Aliwal North. Tembuland. Transvaal (Zuikerbosch Rand).

SESUTO: *Letapisoana la naheng*. The small "Letapise" of the country. *Khōtōliea ea thaba*. The "Khōtōlina" of the mountain. Mixed with tobacco to make it milder.

var. **glabrior**, Harv.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8200!

DISTRIBUTION: Transvaal (Carolina).

**S. serratus**, Sond.

Stony spots on veld and mountain slopes. 8-26 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 644!

DISTRIBUTION: Cape. Queenstown. Graaff Reinet. Tembuland. Natal. Transvaal (Volksrust).

SESUTO: *Letapiso*. The diminisher of strength. A person suffering with swollen limbs or internal tumours is washed with a decoction prepared from the entire plant.

**S. hastulatus**, Linn.

Mountain slopes. 10-20 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 344b! 498a!; Basutoland, without precise locality, *Cooper*, 715!; near Buffalo River Waterfall, 8200 ft., March, *Galpin*, 6720!, Doodman's Krans Mtn., 9200-9650 ft., March, *Galpin*, 6721.

DISTRIBUTION: Natal.

SESUTO: *Khōtōliea ea kholo*. The big "Khōtōliea." *Sekhatlana*. Small notches.

var. **nudiuseculus**.

Mountain slopes. 10-20 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 498b!

DISTRIBUTION: Uitenhage. Beaufort West.

SESUTO: *Sekhatlana*. Small notches.

**S. hieracioides**, DC.

Mountain slopes and banks of streams. Flowers yellow. Summer-Autumn. *A. Dieterlen*, 344a!; Doodman's Krans Mtn., 8900 ft., March, *Galpin*, 6718!

DISTRIBUTION: Natal.

SESUTO: *Khōtōliea e kholo*. The big "Khōtōliea."

**S. Bellis**, Harv. ?

Ben McDhui, 9400 ft., March, *Galpin*, 6722.

**S. reptans**, Turcz. \*

Summit of the Mont-aux-Sources, 9500 ft., December, *Flanagan*, 1951!

DISTRIBUTION: Middleburg. Molteno. Griqualand West.

**S. dregeanus**, DC., var. **discoideus**.

Mountain slopes and plateau. 12-30 in. high, flowers violet. Summer. *A. Dieterlen*, 130!

DISTRIBUTION: Tembuland. East Griqualand. Natal. Swaziland.

SESUTO: *Sebilwane*. The small black stone. *Mantvana*. Small feet. *Lehlomane le lenyenyane*. The small "Lehlomane." A decoction of the roots is drunk to bring on vomiting in cases of a cold in the chest. It is also given to madmen and is supposed to free them from their madness.

**S. coronatus**, Harv.

Veld and mountain slopes. 10-22 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 60! 934!

DISTRIBUTION: Port Elizabeth. Albany. Graaff Reinet. Aliwal North. Transkei. Tembuland. East Griqualand. Transvaal (Barberton, Rustenburg).

SESUTO: *Motabo*. A mixture. *Papetloane e tabang koae*. The "Papetloane" to be mixed with tobacco. *More-moholo*. The big medicine. *Lehlomanyane*. The small "lehlomane." Used as an emetic, and to mix with tobacco.

*Dieterlen* 60 is a broad leaf-form, the leaves being from 6.5-7.5 cm. broad.

**S. albanensis**, DC.

Malavaneng, Leribe District, flowers yellow. *A. Dieterlen*, 934!; slopes of ravine between the Mission Station and Jonathan's Village, common, *Phillips*, 564!

DISTRIBUTION: Knysna. Uitenhage. Albany. Queenstown.

var. *leiophyllus*.

Veld and mountain slopes. 10-22 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 477a!

DISTRIBUTION: Natal. East Griqualand.

SESUTO: *Lehlomanyane*. The small "Lehlomane." A preparation for use in colic pains is made from the roots.

**S. inornatus**, DC. (*ex descr.*)

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1870!

DISTRIBUTION: Albany.

This plant agrees with the description in the 'Flora Capensis.' The heads are 5-6-rayed, with about 15 disc-florets.

**S. monticolus**, DC. (*ex descr.*)

Mountain slopes. Flowers yellow. Summer (December). *A. Dieterlen*, 834!; Wittebergen, 3500-6000 ft., *Drege*.

DISTRIBUTION: Endemic.

SESUTO: *Lehlomane ba thaba*.

**S. macrospermus**, DC.

Slopes of high mountains at Sehonghong. Flowers yellow. Summer. *A. Dieterlen*, 784!; valley above the Buffalo River Waterfall, c. 8000 ft., March, *Galpin*, 6728!; Ben McDhui, 9250 ft., March, *Galpin*, 6727!; Wittebergen, 6000 ft., *Drege*.

DISTRIBUTION: Endemic.

SESUTO: *Poli-tsohana*. The white she-goat. *Lesira*. A veil. A charm is made from the plant for native warriors to render them invisible to the enemy.

**S. gramineus**, Harv.?

Doodman's Krans Mtn. and Ben McDhui, 9000-9700 ft., March, *Galpin*, 6724-6726.

**S. gramineus**, Harv.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1955!

DISTRIBUTION: Graaff Reinet.

**S. polyodon**, DC. (*ex descr.*)

Bester's Vlei, near Witzie's Hoek, 6400 ft., December, *Flanagan*, 1843!

DISTRIBUTION: Near the Little and Great Fish Rivers.

**S. othonnaeflorus**, DC.

Veld and mountain slopes. 15-30 in. high, flowers yellow.

Summer. *A. Dieterlen*, 477b!; north slopes of Leribe plateau, *Phillips*, 676!; Bester's Vlei, near Witzie's Hoek, 5400-6700 ft., December, *Bolus*, 8202! *Flanagan*, 1847!; Natal, in swamp at Van Reenen, 5-6000 ft., December, *Wood*, 5842.

DISTRIBUTION: Uitenhage. Humansdorp. Albany. Murraysburg. Graaff Reinet. Molteno. Aliwal North. Stutterheim. East Griqualand. Transvaal. (Wilge River).

SESUTO: *Lehlomanyane*. The small "lehlomane." A very strong emetic.

### *S. rhomboideus*, Harv.

Natal, Van Reenen, 5-6000 ft., December, *Wood*, 4535.

DISTRIBUTION: Transkei.

### *S. paucifolius*, DC.

Mountain slopes. 12-30 in. high, flowers yellow. Summer. *A. Dieterlen*, 412!

DISTRIBUTION: Port Elizabeth. Graaff Reinet. Aliwal North. East Griqualand. Orange Free State (Bloemfontein). Transvaal (Landspruit).

SESUTO: *Lekoto la litsšene*. The trickling of rain. *Lelulta la pula*. The "Lelulta" of the monkeys. The native doctors believe the plant to be the female of No. 674.

### *S. bupleuroides*, DC.

River banks and mountain slopes. 9-22 in. high, flowers yellow. Summer. *A. Dieterlen*, 403!; north slopes of Leribe plateau, *Phillips*, 685!; Bester's Vlei, near Witzie's Hoek, 5400-6500 ft., December-January, *Bolus*, 8195! *Flanagan*, 1998!

DISTRIBUTION: East Griqualand. Natal. Swaziland. Transvaal (Pretoria, Johannesburg).

SESUTO: *Lehlogoane*. The small "Lehlomane." *Lereka*. Mercy. Mixed with other plants, it is highly esteemed in chest complaints.

On the sheet (*Bolus*, 8195), in the *Bolus Herbarium*, is the following note: "*S. bupleuroides*, DC., by its radiate heads, but otherwise it seems as near or near *S. venosus*, Harv., and both species are probably forms of one."

### *S. isatideus*, DC.

Mountain slopes. 12-40 in. high, flowers yellow. Summer. *A. Dieterlen*, 587!; ravine on west slopes of plateau, frequent, *Phillips*, 598!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8201! *Flanagan*, 1904!



**DISTRIBUTION:** Albany. Somerset East. Transkei. Tembuland. East Griqualand. Natal.

**SESUTO:** *Lehlomane le leputsoa*. The grey "Lehlomane."

**S. Gerrardi**, Harv.

Mountain slopes. Flowers violet. Autumn. *A. Dieterlen*, 635 ! 503 !

**DISTRIBUTION:** East Griqualand. Natal. Zululand. Swaziland. Transvaal (Houtbosch).

**SESUTO:** *Moroborobo o monyenyanane*. The small "Moroborobo." A decoction of the roots is drunk as an emetic in bilious attacks.

**S. serratuloides**, DC.

River Banks at Matalane, Leribe District, 3-5 ft. high, flowers yellow. Autumn. *A. Dieterlen*, 778 !

**DISTRIBUTION:** Port Elizabeth. Komgha. Transkei. East Griqualand. Natal.

**SESUTO:** *Khōtōliea ea nōko*. The "Khōtōliea" of the river.

**S. serra**, Sond.

Veld and mountain slopes. 20-45 in., flowers yellow. Summer-Autumn. *A. Dieterlen*, 113 !; ravine on west slopes of plateau, *Phillips*, 760 !; between Tent Kop and Antelope Park, 5600 ft., March, *Galpin*, 6731 ; Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus* !; Natal, Van Reenen, 8000 ft., March, *Schlechter*, 6998 !

**DISTRIBUTION:** Caledon. Graaff Reinet. Somerset East. East Griqualand. Bechuanaland. Transvaal (Pietersburg).

**SESUTO:** *Lehlomane le leholo*. The big "Lehlomane" (from "hohloma"—to plant).

**S. tanacetoides**, Sond.

Stony places on plateau. 10-25 in. high, flowers yellow. Autumn. *A. Dieterlen*, 582 !; river at the foot of the Mont-aux-Sources, 8-9000 ft., March, *Evans*, 756.

**DISTRIBUTION:** Somerset East. Tembuland.

**SESUTO:** *Mosuvane oa matlapa*. The "Mosuvane" of the flat stones. *Molepèllè*. The hanging one. The leaves are smoked to stop bleeding of the nose.

**S. achilleaeefolius**, DC.

Doodman's Krans Mtn., and Ben McDhui, 9600-9800 ft., March, *Galpin*, 6732 ! 6733.

**DISTRIBUTION:** Queenstown. Graaff Reinet. Aliwal North. East Griqualand. Natal.

**S. pinnatifidus**, Less.

Natal, Polela, 6-7000 ft., April, *Wood*, 4598.

DISTRIBUTION: Piquetberg. Tulbagh.

**S. rhyncholaenus**, DC.

Mountain slopes and plateau. 5-16 in. high, flowers mauve. Summer. *A. Dieterlen*, 408!

DISTRIBUTION: Pondoland. Natal. Transvaal (Barberton).

SESUTO: *Mahoaneng*. Meaning unknown. This plant is largely used by the native witch-doctors. For colds, either the leaves are smoked, or the plant is burnt and the smoke inhaled. A decoction prepared from the roots is drunk to relieve colic pains. To cure sore feet and hands the patient is taken to some running water and incisions are made in the limbs in which the ash, from the incinerated plant, is placed. The blood is carried away by the stream and the pain is supposed to accompany it.

This specimen matches *Wood*, 5221, from Mooi River, Natal. The plants from Barberton (*Galpin*, 1343) and Pondoland (*Flanagan*, 2576) are less scabrous and almost glabrous.

**S. serrulatus**, DC. (*ex descr.*)

Valley above the Buffalo River Waterfall, c. 8100 ft., March, *Galpin*, 6734!; Wittebergen, 6-7000 ft., *Drège*.

DISTRIBUTION: Endemic.

**S. brachypodus**, DC.

Mountain slopes. 3-5 ft. high, flowers yellow. Autumn-Winter. *A. Dieterlen*, 723!

DISTRIBUTION: Komgha. Transkei. East Griqualand.

SESUTO: *Lephokō*. Derived from the verb "ho phoka"—to drink a hot beverage by small sips. Used as an infusion for colds and chest complaints.

**S. speciosus**, Willd.

Doodman's Krans Mtn. and Ben McDhui, 9300-9600 ft., March, *Galpin*, 6714.

See note under *S. concolor*, DC.

**S. Baurii**, Oliv.

Plains, near Pot River, Maclear District, 4600 ft., March, *Galpin*, 6730.

DISTRIBUTION: Tembuland.

**S. Dieterlenii**, Phillips, sp. nov. *Herba* 26-80 cm. alta. *Folia* 4.5-13.5 cm. longa, 2-6.5 cm. lata, elliptica, glabra. *Pedunculus*

30 cm. longus, glaber. *Capitula* in laxa panicula disposita. *Bractee* 3-4 mm. longae, lineares vel subulatae, apice acutae, glabrae. *Capitulum* discoideum, circiter 1.2 cm. longum, 1.3-1.5 cm. latum. *Bractee* involucae circiter 13, 9 mm. longae, 1 mm. latae, lineares, apice subacutae, vel obtusae ciliataeque, glabrae, marginatae. *Tubus* corollae 6 mm. longus, infra cylindratus, supra campanulatus, glaber; lobi .75 mm. longi, circiter .5 mm. lati, ovato-oblongi, apice obtusi. *Pappus* 6-7 mm. longus, barbellatus. *Ovarium* 3.5 mm. longum, 1 mm. latum, paullo pubescens; stylus 6 mm. longus, teres, basi globosus; lobi 1.5 mm. longi. *Fructus* 4.5 mm. longus, .75 mm. latus, teres, costatus, paullo strigosus.

Mountain slopes, flowers yellow. Summer. *A. Dieterlen*, 674!; Natal, summit of the Drakensbergen, near Van Reenen's Pass, 5800 ft., November, flowers yellow, *Wood*, 4764!

(In *Wood's List of Natal Plants*, *Wood*, 4764 is given as *S. angustatus*, Linn. f.)

SESUTO: *Lekoto la litsöene. Lelutla la pula.*

An erect subherbaceous plant, 26-80 cm. high, with a woody underground rootstock. *Stem* leafy, ending in a simple or racemosely branched peduncle, glabrous. *Leaves* 4.5-13.5 cm. long, 2-6.5 cm. broad, elliptic, obtuse, sessile or narrowed at the base into a flattened petiole, subentire or somewhat lobed, glabrous. *Peduncle* up to 30 cm. long, striate, glabrous. *Capitula* arranged in a loose panicle. *Bracts* 3-4 mm. long, linear or subulate, subacute, glabrous. *Peduncles* .8-2.5 cm. long, glabrous. *Capitulum* discoid, about 1.2 cm. long and 1.3-1.5 cm. in diameter, obovate in outline, with 1-2 bracteoles at the base of the involucre. *Receptacle* slightly convex. *Involucre* of about 13 bracts; bracts 9 mm. long, 1 mm. broad, linear, subacute or obtuse, shortly ciliated at the apex, glabrous, with membranous margins. *Corolla-tube* 6 mm. long, cylindric in the lower half, suddenly widened into a narrow campanulate portion in the upper half, glabrous; lobes .75 mm. long, about .5 mm. broad, ovate-oblong, obtuse, glabrous. *Pappus* 6-7 mm. long, barbellate. *Ovary* 3.5 mm. long, 1 mm. broad, linear-oblong in outline, scantily pubescent, many-nerved; style 6 mm. long, terete, with a distinct central vein, globose at the base, glabrous; lobes 1.5 mm. long. *Fruit* 4.5 mm. long, .75 mm. broad, terete, ribbed, strigulose.

Near *S. rhomboideus*, Harv., from which it differs in having more than nine involucreal bracts.

**S Evansii**, N. E. Br.

Natal. Drakensberg Mountains. 6-7000 ft., *Evans*, 366.

**DISTRIBUTION**: Endemic.

**S. Flanaganii**, Phillips, sp. nov. (§ Plantagieni.) *Planta* simplex, paullo pilis byssinis tecta vel glabra. *Caulis* 5–7 mm. latus, striatus. *Folia* caudicis 3·5–26·7 cm. longa, 6–6 cm. lata, lanceolata, apice obtusa, basi angustata, subamplexicaulia, subtus promineo unicosata; juniora interdum pilis byssinis tecta vel glabra; margines callosodentatae. *Bracteae* 2–3·2 cm. longae, basi 3–5 mm. latae, ovatae, acuminatae, pilis byssinis tectae. *Capitula* 1·3 cm. longa, 1·5 cm. lata, discoidea. *Bracteae involucae* circiter 15, 7 mm. longae, 1·5–2·5 mm. latae, apice obtusae glandulosaeque, glabrae; margines membranaceae. *Tubus corollae* 6·5 mm. longus, basi 5 mm. latus cylindratusque, supra 1·5 mm. latus campanulatusque; lobi 1·25 mm. longi, 75 mm. lati, ovati, apice obtusi. *Filamenta* 1·5 mm. longa, filiformia, supra dilata; antherae 2·5 mm. longae, lineares. *Pappus* 7 mm. longus, barbellatus, deciduus. *Ovarium* 2·5 mm. longum, 75 mm. latum, striatum, rostratum, glabrum; stylus 6·5 mm. longus, basi bulbaceus, glaber; lobi 1·5 mm. longi.

Bester's Vlei, near Witzie's Hoek, 5400–5500 ft., December–January, Bolus, 8193, Flanagan, 2089.

A simple subherbaceous plant. *Stem* 5–7 mm. in diameter, ribbed, sparsely cottony, otherwise glabrous. *Lower leaves* not seen. *Cauline leaves* 3·5–26·7 cm. long, 6–6 cm. broad, lanceolate, obtuse, narrowing at the base and subamplexicaule, with callose-dentate margins and a prominent midrib beneath, the younger leaves sometimes cottony. *Heads* arranged in a racemose or paniced manner, the ultimate branches bearing 2–3 heads. *Bracts* 2–3·2 cm. long, 3–5 mm. broad at the base, ovate, acuminate, cottony. *Bracteoles* 6–1 cm. long, linear. *Heads* 1·3 cm. long, 1·5 cm. in diameter, discoid, many-flowered, calyced at the base. *Involucre* of about 15 bracts; bracts 7 mm. long, 1·5–2·5 mm. broad, obtuse, glandular and dark-coloured at the apex, glabrous, with membranous margins. *Receptacle* flat, honeycombed. *Corolla-tube* 6·5 mm. long, cylindric, and 5 mm. broad in the lower half, campanulate and 1·5 mm. broad in the upper half, glabrous; lobes 1·25 mm. long, 75 mm. broad, ovate, obtuse. *Stamens* inserted at the junction of the two portions of the corolla-tube; filaments 1·5 mm. long, filiform, swollen above; anthers 2·5 mm. long, linear, with an ovate gland at the apex. *Pappus* 7 mm. long, barbellate, deciduous. *Ovary* 2·5 mm. long, 75 mm. broad, terete, striate, beaked, glabrous; style 6·5 mm. long, filiform, bulbous at the base, glabrous; lobes 1·5 mm. long.

Near *S. digitalifolius*, DC., from which it differs in having radiate flowers.

**forma glabra.**

A typo caulibus foliisque glabris, etiam floribus capitulisque paullo minoribus differt.

This is a perfectly glabrous form without the cottony hairs which characterise the species. The heads and flowers are slightly smaller, otherwise similar to the type.

Tembuland, Chenkwe Mt., between Maclear and Umtata, 3500 ft. January, *Planagan*, 2656; East Griqualand, in stony places near Maclear, 4700 ft., January, *Bolus*, 16152.

Although this form does not come with the region dealt with in this paper, I thought this the proper place to mention it.

**S. harveianus**, MacOw.

Veld and gardens. 6-26 in. high, flowers yellow. Spring-Autumn. *A. Dieterlen*, 50!; on banks of streams and various localities round Leribe plateau, *Phillips*, 533! 712! 787!; Qoqolosi Peak, a small bush, flowers yellow, *Phillips*, 934!

DISTRIBUTION: Natal.

SESUTO: *Khōtōliea*. Meaning unknown.

**S. launayaefolius**, O. Hoffm. (*ex descr.*)

Natal, Bushman's River Valley, 6-8000 ft., October, *Wood*, 10605!; near Hoffenthal, 4000 ft., January, flowers yellow, *Wood*, 681!

DISTRIBUTION: Endemic.

**S. macrophyllus**, *Phillips*, sp. nov. (§ *Paucifolii*). *Planta* simplex, subherbacea, 1 m. alta. *Caulis* foliaceus, teres, 6-9 mm. latus, striatus, glaber. *Folia* sessilia, 9-26.4 cm. longa, 4-5.2 cm. lata, elliptica, acuminata, apice obtusa, basi auricularia, amplexicauliaque, subtus promineo unicastata et distincte nervigera, glabra. *Capitula* in densum corymbum disposita. *Pedunculus* 1-1.5 cm. longus, teres, glaber, nudus vel 1-2-bracteatus. *Bracteae* 2.5 mm. longae, ovato-lanceolatae, apice subacutae, concavae, unicastatae, glabrae. *Capitula* discoidea, 4-5-florifera. *Bracteae involucri* 5, 8 mm. longae, 1.5 mm. latae, lineares, apice obtusae, trinervigerae, glabrae; margines membranaceae. *Tubus corollae* 6 mm. longus, .5 mm. latus, infra cylindratus, basi paullo dilatus, supra campanulatus, glaber. *Filamenta* 1.75 mm. longa, supra dilata, glabra; antherae 3 mm. longae, lineares. *Pappus* 7 mm. longus, barbellatus. *Ovarium* 3 mm. longum, 1 mm. latum, oblongum, rostratum, striatum, glabrum; stylus 1 cm. longus, glaber, basi bulbaceus; lobi 1.5 mm. longi.

Orange Free State, bank of the Wilge River, near Harrismith, c. 5000 ft., February, flowers yellow, *Wood*, 4745; Natal, Newcastle



and De Beer's Pass, 5-6000 ft., December, *Wood*, 5981; Estcourt, 3500 ft., December, *Wood*, 3612; Houtbosch, Pietersburg District, c. 5200 ft., February, *Bolus*, 10993; moist places at Lydenburg, 4800 ft., December, *Schlechter*, 3956. (Wood on one of his tickets states that his No. 4745 = *Cooper*, 990.)

A tall, simple, subherbaceous plant about 1 m. high. *Stem* leafy throughout, terete, 6-9 mm. in diameter, ribbed, glabrous. *Leaves* sessile, 9-26.4 cm. long, 4-5.2 cm. broad, elliptic, shortly acuminate, obtuse, eared and stem-clasping at the base, dentate, with a prominent midrib and distinct veining beneath, glabrous. *Capitula* arranged in a dense corymbose manner. *Peduncles* 1-1.5 cm. long, slender, terete, glabrous, naked or bearing 1-2 bracts. *Bracts* 2.5 mm. long, ovate-lanceolate, subacute, concave, 1-nerved, glabrous. *Capitulum* discoid, 4-5-flowered. *Involucral bracts* 5, 8 mm. long, 1.5 mm. broad, linear, obtuse, 3-nerved, glabrous, with membranous margins. *Corolla-tube* 6 mm. long, .5 mm. broad, cylindric below and somewhat dilated at the base, suddenly expanded into a short campanulate tube above, glabrous; lobes 4 mm. long, 1 mm. broad, linear, obtuse, glabrous. *Stamens* inserted on the campanulate portion of the corolla-tube; filaments 1.75 mm. long, filiform, swollen at the apex, glabrous; anthers 3 mm. long, linear, with a narrow ovate-lanceolate gland at the apex. *Pappus* 7 mm. long, rough. *Ovary* 3 mm. long, 1 mm. broad, oblong in outline, beaked, ribbed, glabrous; style 1 cm. long, exserted in old flowers, terete, glabrous, bulbous at the base; lobes 1.5 mm. long.

A very distinct plant, near *S. isatideus*, DC., and *S. venosus*, Harv. From the former it differs in being leafy throughout and has differently shaped leaves, and the styles are much more exserted. From *S. venosus*, Harv., it differs in the shape of the leaves and in having only 4-5 flowers in each head. *Bolus* 10993 was named *S. venosus* at Kew.

***S. montanus***, Phillips, sp. nov. (§ Sinuosi.) *Planta* 18-22 cm. altus. *Folia* radicalia 2-2.7 cm. longa, .6-1.2 cm. lata, elliptica vel lanceolata, apice obtusa, basi attenuata, integra, glandulosa mox glabra; folia caulina .5-2.3 cm. longa, 1-4 mm. lata, linearia vel subulata, apice obtusa vel acuta, basi caulem amplexa, glandulosa. *Pedunculus* 13.5-20 cm. longus, unicapitatus. *Bracteae* involucrae 1 cm. longae, 1-1.5 cm. latae, lineares, apice obtusae, marginatae, subtus glandulosae. *Corolla* radii bilabiata; tubus 8 mm. longus, .5 mm. latus, cylindratus, glaber. *Ovarium* 2 mm. longum, .5 mm. latum, lineare; stylus 5 mm. longus, filiformis; lobi 1 mm. longi.

*Tabus* disci 5 mm. longus, infra cylindratus, supra campanulatus, glaber; lobi .75 mm. longi, .5 mm. lati, ovati, apice obtusi. *Filamenta* 1 mm. longa; antherae 1.3 mm. longae, lineares. *Ovarium* 4 mm. longum, .75 mm. latum, lineare, circiter 12-costatum, glabrum; stylus 5 mm. longus, basi globosus; lobi 1.25 mm. longi. *Pappus* 5.5 mm. longus, deciduus.

Summit of the Mont-aux-Sources, 9500 ft., December, Flanagan, 1948.

A simple plant, 18–22 cm. high, with 1 or 2 peduncles and radical leaves. *Radical leaves* 2–2.7 cm. long, .6–1.2 cm. broad, elliptic or lanceolate, obtuse, attenuate at the base, entire, glandular with multicellular hairs which disappear with age; cauline leaves narrowing upwards, .5–2.3 cm. long, 1–4 mm. broad, broadly linear to subulate, obtuse or acute, subamplexicaule, glandular with multicellular hairs. *Peduncles* 13.5–20 cm. long, one-headed. *Capitulum* radiate, 1.7 cm. long, 2 cm. broad. *Receptacle* flat, honeycombed. *Involucral bracts* 1 cm. long, 1–1.5 mm. broad, linear, obtuse, 1–2-nerved, with membranous margins, densely glandular beneath with multicellular hairs. *Ray-florets* blue?, bilabiate (sometimes the lips adhere together), female. *Corolla-tube* 4 mm. long, .5 mm. broad, cylindric, glabrous; lower limb 8 mm. long, 2.6 mm. broad, linear-oblong or oblanceolate, rounded and 3-toothed at the apex, glabrous; upper lip 8 mm. long, 1 mm. broad, obtuse. *Ovary* 2 mm. long, .5 mm. broad, linear; style 5 mm. long, filiform, swollen at the base; lobes 1 mm. long. *Disc-florets* hermaphrodite. *Corolla-tube* 5 mm. long, cylindric in the lower half, campanulate above, glabrous; lobes .75 mm. long, .5 mm. broad, ovate, obtuse. *Stamens* inserted at the widened part of the corolla-tube; filaments 1 mm. long, filiform, slightly swollen above; anthers 1.3 mm. long, linear, with an oblong or elliptic gland at the apex. *Ovary* 4 mm. long, .75 mm. broad, linear, about 12-ribbed, glabrous; style 5 mm. long, filiform, globose at the base, glabrous; lobes 1.25 mm. long. *Pappus* 5.5 mm. long, deciduous.

Near *S. macrocephalus*, DC., from which it differs in only having one head to each peduncle.

### **S. napifolius**, MacOw.

Eland's River Valley at foot of the Mont-aux-Sources, near Witzie's Hoek, 6–7000 ft., December, Bolus, 8198!

DISTRIBUTION: Natal (Weenen County, 4–5000 ft.).

### **S. seminivea**, Wood & Evans.

River banks. A bush 3–4½ ft. high, flowers yellow. Autumn.

Makokvane, Leribe District, *A. Dieterlen*, 802!; top of the Mont-aux-Sources, 11,000 ft., March, *Evans*, 752!

DISTRIBUTION: Endemic.

SESUTO: *Khōtōliea ea nōka*. The "Khōtōliea" of the river. Used as fuel in winter.

This plant apparently only differs from *S. achillaeifolia*, DC., in having glandular stems and leaves, and may only be a variety of that species.

**S. subcoriaceus**, Schltr.

Veld, mountain slopes and plateau. 2-15 in. high, flowers yellow. Spring. *A. Dieterlen*, 612!

DISTRIBUTION: Tembuland. Natal. Transvaal (Ermelo, Bethal, Middleburg, Volksrust).

SESUTO: *Ngvakoane*. The small "Ngvako" (a child born after an elder brother or sister has died). The roots are employed in various illnesses and must only be administered by a "Ngvako."

**S. tugelensis**, Wood & Evans.

Natal, summit of the Mont-aux-Sources, 11,000 ft., March, *Evans*, 750!; Doodman's Krans Mtn., 8900 ft., March, *Galpin*, 6723!

DISTRIBUTION: Endemic.

**S. subrubriflorus**, O. Hoffm. (= *S. viscidus*, N. E. Br.) (*ex descr.*).

Bester's Vlei, near Witzie's Hoek, 5400-6000 ft., December, *Bolus*, 8197!; *Flanagan*, 1885!; Witzie's Hoek, c. 6000 ft., *Thode*!

DISTRIBUTION: East Griqualand. Natal.

**S. sp.**

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8196

DISTRIBUTION: Endemic.

A fruiting specimen only.

**S. sp.**

Bester's Vlei, near Witzie's Hoek, 5800 ft., December, *Bolus*, 8194

**S. sp.** (near *S. cordifolius*, Linn.)

Natal, Bushman's River Valley, 8-9000 ft., October, flowers yellow *Wood*, 10663!

**S. sp.** (near *S. dregeanus*, DC., var *discoideus*.)

Near Harrismith, 5000 ft., February, *Wood*, 4754!

The peduncle is scabrid.

**S. sp.**

Summit of the Mont-aux-Sources, 11,000 ft., *Evans*, 743!

DISTRIBUTION: Endemic.

## HERTIA, Less.

**H. sp.**

Near the Buffalo River Waterfall, 7500 ft., March, *Galpin*, 6740!

## EURYOPS, Cass.

**E. multifolius**, DC.

Basutoland, without precise locality, *Cooper*, 736!

DISTRIBUTION: S.W. Africa. Clanwilliam. Fraserburg. Albert. Orange Free State (Bloemfontein).

**E. oligoglossus**, DC.

Basutoland, near the Buffalo River Waterfall, 8100 ft., March, *Galpin*, 6735!

DISTRIBUTION: Worcester. Ceres. Queenstown. Murraysburg. Graaff Riet. Aliwal North.

**E. Candollei**, Harv.

Doodman's Krans Mtn. and Ben McDhui, 9200-9900 ft., March, *Galpin*, 6736!

DISTRIBUTION: Queenstown. Graaff Riet.

**E. laterifolius**, Less.

Valley above the Buffalo River Waterfall, 8100 ft., March, *Galpin*, 6737!

DISTRIBUTION: Namaqualand Minor. Beaufort West. Murraysburg. Hutchinson. Laingsburg. Albert.

**E. Annae**, Phillips, sp. nov. (Pl. IV.) *Suffrutex* 15-25 cm. altus. *Rami* et *ramuli* glabri. *Folia* 1.3-1.7 cm. longa, 1 mm. lata, linearia, apice acuta, glabra. *Inflorescentia* axillaris. *Pedunculus* 1.5-2.5 cm. longus, teres, glaber. *Bractae* involucrae 5, basi connatae, 4-4.5 mm. longae, 1.5 mm. latae, ovatae, acuminatae, apice obtusae, glabrae, marginatae. *Corolla* radii 4.2 mm. longa; tubus .75 mm. longus, teres, glaber; limbus, 3.5 mm. longus, 1.5 mm. latus, oblongus, apice obtusus, minute 3-dentatus. *Ovarium* 1 mm. longum, 4-gonum, glabrum. *Corolla* disci 3.75 mm. longa; tubus 3 mm. longus, infra cylindricus, supra campanulatus, glaber; lobi .75 mm. longi, ovati, apice obtusi. *Filamenta* 1 mm. longa; antherae 1.5 mm. longae, lineares. *Ovarium* .75 mm. longum, glabrum. *Pappus* 1 mm. longus, barbatus, caducus.

Qoqolosi Peak on Leribe plateau, January-February, *A. Dieterlen*, 941, *Phillips*, 937.

SESUTO: *Sehlakoana se senyenyane*. The small "Sehlakoana." *Sehalahala sa Qoqolosi*. The "Qoqolosi Bush." Said to be a very valuable medicine, also enters largely into the preparation of charms.

A small shrub 15–20 cm. high. *Branches* and branchlets glabrous. *Leaves* 1·3–1·7 cm. long, 1 mm. broad, linear, acute, glabrous. *Capitula* axillary, massed at the end of the branchlets. *Peduncles* 1·5–2·5 cm. long, terete, glabrous. *Involucre* of 5 bracts united at the base; bracts 4–4·5 mm. long, 1·5 mm. broad, ovate, acuminate, obtuse, glabrous, with narrow membranous margins. *Receptacle* honeycombed. *Ray-florets* female. *Corolla-tube* ·75 mm. long, terete, glabrous, limb 3·5 mm. long, 1·5 mm. broad, oblong, obtuse, minutely 3-toothed at the apex, 4-nerved. *Ovary* 1 mm. long, 4-angled, glabrous. *Disc florets* hermaphrodite. *Corolla-tube* 3 mm. long, cylindric in the lower half, campanulate above, glabrous; lobes ·75 mm. long, ovate, obtuse. *Stamens* inserted in the widened portion of the corolla-tube; filaments 1 mm. long; anthers 1·5 mm. long, linear, with an ovate appendage at the apex. *Ovary* ·75 mm. long, terete, glabrous. *Pappus* 1 mm. long, barbate, caducous.

In appearance this species is very similar to *E. linifolius*, DC., but can readily be distinguished from it by the fact that the involucre is only made up of 5 bracts, which are not strongly 3-ribbed. The shape of the disc-floret is also very different.

#### **E. Evansii**, Schltr.

Slopes of high mountains, Pitseng, Leribe District. 4–8 ft. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 465!; summit of Drakensberg, March, *Evans*, 752.

**DISTRIBUTION:** Endemic.

**SESUTO:** *Sehlaakoana*. Meaning unknown. The stem is burnt and smoked as a cure for headache.

The species described by the late Dr. M. Wood (Kew Bull., 1914, 335) as *E. Dieterlenii* is this species.

**E. Galpinii**, Phillips, sp. nov. *Rami* et ramuli glabri. *Folia* ericaea, patentia, 3–4 mm. longa, basi ·5–1 mm. lata et saepe marginibus glandulosis, super plana, subtus convexa, apice acuta mucronataque. *Capitula* solitaria, axillaria, 4–5 mm. longa, circiter 1 cm. lata. *Pedunculus* 1·3–2·5 cm. longus, teres, glaber. *Bractae* involucrae 8, connatae, trinervigerae, glabrae; tubus 2·5 mm. longus, 3 mm. latus, campanulatus; lobi 1·5–2 mm. longi, ovati, apice acuti vel subacuti glandulosique. *Flores* radii 6·25 mm. longi; tubus ·75 mm. longus, cylindricus, glaber; limbus 5·5 mm. longus, 3 mm. latus, ellipticus, apice obtusus et tridentatus. *Ovarium* 1 mm. longum, ·5 mm. latum, obovatum, glabrum; stylus 1·5–2 mm. longus, teres; lobi ·5 mm. longi. *Pappus* 1·75 mm. longus, barbellatus, deciduus. *Flores* disci 2·6 mm. longi; tubus 2·5 mm. longus, infra cylindricus, supra



campanulatus, glaber; lobi 1 mm. longi, .5 mm. lati, ovati, obtusi. *Filamenta* .75 mm. longa, filiformis; antherae 1 mm. longae, lineares. *Ovarium* .75 mm. longum, .3 mm. latum, oblongum, glabrum; stylus 2.5 mm. longus, teres, apice bifidus, basi subgloboseus. *Pappus* 1.75 mm. longus, barbellatus, deciduus.

Tsitsa Footpath on the Drakensbergen, District Maclear, c. 8200 ft., *Galpin*, 6739.

*Branches* and branchlets glabrous. *Leaves* ericoid, horizontal, 3–4 mm. long, .5–1 mm. broad at the base, flat above, keeled beneath, acute, mucronate, expanded and flattened at the base, glabrous, usually with a few stalked glands on the margins. *Capitula* solitary, axillary, 4–5 mm. long, about 1 cm. wide when measured across the rays. *Peduncle* 1.3–2.5 cm. long, terete, glabrous. *Involucre* of 8 connate 3-nerved glabrous scales; tube 2.5 mm. long, 3 mm. wide, campanulate; lobes 1.5–2 mm. long, ovate, acute or subacute, with a few glandular hairs at the apex. *Ray-florets* female; tube .75 mm. long, cylindric, glabrous; limb 5.5 mm. long, 3 mm. broad, elliptic, obtuse, bluntly 3-toothed at the apex. *Ovary* 1 mm. long, .5 mm. broad, obovate in outline, glabrous; style 1.5–2 mm. long, terete; lobes .5 mm. long. *Pappus* 1.75 mm. long, barbellate, deciduous. *Disc-florets* hermaphrodite; tube 2.5 mm. long, narrow-cylindric in the lower half, broadly campanulate above; lobes 1 mm. long, .5 mm. broad, ovate, obtuse. *Stamens* inserted at the junction of the two portions of the corolla-tube; filaments .75 mm. long, filiform; anthers 1 mm. long, linear. *Ovary* .75 mm. long, .3 mm. broad, oblong in outline, glabrous; style 2.5 mm. long, terete, bifid at the apex, subglobose at the base. *Pappus* 1.75 mm. long, barbellate, deciduous.

Allied to *E. oligoglossus*, DC., from which it differs in the peduncles being much longer than the leaves and by having glabrous ovaries.

### **E. montanus**, Schltr.

Tsitsa Footpath, Drakensberg, 9200 ft., March, *Galpin*, 6738!; stony places on the summit of the Mont-aux-Sources, c. 9000 ft., January, an erect or prostrate shrub, *Thode*, 30!, 9800–10,000 ft., January, *Bolus*, 6393! *Flanagan*, 1949!

DISTRIBUTION: Endemic.

### **E. multinervis**, N. E. Br.

Bester's Vlei, near Witzie's Hoek, 6500 ft., January, *Flanagan*, 1994!

DISTRIBUTION: Endemic.

**E. pedunculatus**, N. E. Br.

Bester's Vlei, near Witzie's Hoek, 6400–6700 ft., December, *Bolus*, 8204! *Flanagan*, 1854!; Natal, Oliver's Hoek, 4–5000 ft., January, *Wood*, 3601; Hlatikulu, 6–7000 ft., January, *Evans*, 397.

DISTRIBUTION; Transvaal (Houtbosch, Zoutpansberg). Orange Free State (no locality).

The specimens collected by Bolus and Flanagan are more robust than those described by Mr. Brown.

**E. setiloba**, N. E. Br.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8203!

DISTRIBUTION: Natal (Newcastle).

**E. Tysonii**, Phillips, sp. nov. *Rami* dense foliiferi. *Folia* imbricata, 8–1·8 cm. longa, 2–5 mm. lata, ovato-lanceolata, lanceolata vel lineari-lanceolata, raro linearia, apice obtusa, coriacea, glabra. *Capitula* axillaria. *Pedunculus* 2·5–4 cm. longus, teres, glaber. *Involucrum* campanulatum, 6–8-bracteatum, glabrum; tubus 5 mm. longus, basi rotundus; lobi 1–1·5 mm. longi, ovati, apice obtusi et glandulosi. *Tubus radii* 1·5–2·5 mm. longus, cylindricus, glaber; limbus 7–1 cm. longus, 2·5–5 mm. latus, oblongus vel oblongo-ellipticus, apice obtusus et tridentatus, 4-nerviger. *Ovarium* 1·5–3 mm. longum, 5–1·5 mm. latum, lineare, glabrum. *Tubus disci* 3·5–4 mm. longus, infra cylindricus, supra campanulatus, glaber; lobi 1 mm. longi, ovati, apice obtusi. *Pappus* 2·5–3 mm. longus, barbellatus, deciduus. *Filamenta* 1·5 mm. longa; antherae 1·75 mm. longae, lineares. *Ovarium* 1·5–2·5 mm. longum, 5 mm. latum, lineare, glabrum; stylus 4 mm. longus, teres, glaber, basi dilatus; lobi 5 mm. longi, apice ciliati.

On the banks of the Eland's River, near the Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2120; rocky places ("krantzies") near and at the top of Plattberg, Harrismith, c. 7200 ft., January, *Thode*; in stony places, Mt. Currie, 6000 ft., February, *Tyson*, 1495.

*Branches* terete, densely leafy, glabrous, rough with the remains of leaf-scars on the older portions. *Leaves* imbricate, 8–1·8 cm. long, 2–5 mm. broad, ovate-lanceolate, lanceolate to linear-lanceolate, rarely linear, obtuse, with a sunken midrib beneath, coriaceous, glabrous. *Capitula* axillary, arranged in a racemose manner at the ends of the branchlets. *Peduncles* 2·5–4 cm. long, terete, glabrous. *Involucre* campanulate, of 6–8 scales, glabrous; tube 5 mm. long, rounded at the base; lobes 1–1·5 mm. long, ovate, obtuse, glandular at the tip. *Ray-florets* female. *Corolla-tube* 1·5–2·5 mm. long, cylindric, glabrous; limb 7–1 cm. long, 2·5–5 mm. broad, oblong or oblong-elliptic,

obtuse, 3-toothed at the apex, 4-nerved. *Ovary* 1·5–3 mm. long, ·5–1·5 mm. broad, linear or oblong in outline, glabrous. *Disc-florets* hermaphrodite. *Corolla-tube* 3·5–4 mm. long, cylindric in the lower half, campanulate in the upper, glabrous; lobes 1 mm. long, ovate, obtuse. *Pappus* deciduous, 2·5–3 mm. long, barbellate. *Stamens* inserted at the junction of the two portions of the corolla-tube; filaments 1·5 mm. long, filiform; anthers 1·75 mm. long, linear, with an ovate gland at the apex. *Ovary* 1·5–2·5 mm. long, ·5 mm. broad, linear in outline, glabrous; style 4 mm. long, filiform, terete, glabrous, swollen at the base; lobes ·5 mm. long, ciliate at the apex.

Closely allied to *E. laterifolius*, Less., from which it may be distinguished by the involucreal scales being joined for at least five-sixths of their length, and the ovaries being quite glabrous.

var. *Dieterlenii*, Phillips, var. nov.

A typo pedunculis 1·2 cm. longis et involucris 4-dentatis differt.

This is distinguished from the type by the peduncle being less than twice as long as the leaves (up to 1·2 cm. long), and the involucre being 4-dentate.

Mountain slopes at Sehonghong, Leribe District. Flowers yellow. Summer (February). *A. Dieterlen*, 904.

DISTRIBUTION: Endemic.

SESUTO: *Sehlakoana se senyenyane*. The small "Sehlakoana."

#### OTHONNA, Linn.

##### *O. natalensis*, Sch. Bip.

Veld and plateau. 8–22 in. high, flowers yellow. Spring–Summer, 8–22 in. high, *A. Dieterlen*, 356!; Mont-aux-Sources, 6000 ft., *A. Bolus* in *Herb. Guthrie*, 4850!

DISTRIBUTION: Somerset East. East Griqualand. Natal. Transvaal (Belfast, Irene).

SESUTO: *Naka*. A horn. *Phela*. Live. The roots are used as a vermifuge for calves suffering with intestinal worms.

##### *O. scapigera*, Harv.

Summit of Satsanna Peak, Drakensberg, Mount Fletcher District, c. 9550 ft., March, *Galpin*, 6741!

DISTRIBUTION: East Griqualand. Natal. Transvaal (Heidelberg, Barberton).

#### DIMORPHOTHECA, Moench.

##### *D. caulescens*, Harv.

Bester's Vlei, near Witzie's Hoek, 6290–6700 ft., December, *Bolus*, 8205! *Flanagan*, 1857; summit of the Mont-aux-Sources, 9500 ft.,

January, rays purple above, yellow beneath, *Flanagan*, 1956!; Ben McDhui, c. 9900 ft., March, *Galpin*, 6742!

DISTRIBUTION: Queenstown. Natal (Mt. Ingogo, 5000 ft.).

**D. Barberiae**, Harv.

Veld and mountain slopes. 7-15 in. high, flowers white, cream and pink. Summer. *A. Dieterlen*, 159!

DISTRIBUTION: Murraysburg. Komgha. East Griqualand. Natal. Transvaal (Belfast, Lydenburg, Barberton, Devil's Kantoer).

SESUTO: *Phela*. Live. *Bohlahlo* and *Mohlalo*. The cause of good-fortune.

**D. Zeyheri**, Sond.

Veld and mountain slopes. 4-6 in. high, flowers yellow. Summer. *A. Dieterlen*, 568!

DISTRIBUTION: Albert.

SESUTO: *Khōtōliea*. Meaning unknown.

OSTEOSPERMUM, *Linn.*

**O. moniliferum**, Linn.

Mountain slopes. A shrub 4-7 ft. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 570!

DISTRIBUTION: Common in the Western Province and also in Knysna, Uitenhage, Albany, Komgha, Pondoland, Natal.

SESUTO: *Ntlo ea lekhoaba*. The house of the rook. *Monokotsvai oa makhoaba*. The mulberry of the rooks. The natives believe that the leafy branches will cure a madman if burnt in his hut.

**O. muricatum**, E. Mey.

Veld, near road from Berea to Qoloheng, flowers yellow. April. *A. Dieterlen*, 990!

DISTRIBUTION: Stellenbosch. Beaufort West. Aliwal North. Natal. Zululand. Griqualand West. Transvaal (Pietersburg, Pretoria).

SESUTO: *Motlapa-tsūnyana*. He who provokes the wind.

URSINIA, *Gaertn.*

**U. montana**, DC.

Mountain slopes and plateau. 3-10 in. high, flowers yellow. Autumn. *A. Dieterlen*, 273!; summit of the Mont-aux-Sources, 9500-11,000 ft., January-March, *Flanagan*, 1953! *Evans*, 744!; Drakensbergen, 6-7000 ft., February, flowers yellow, *Wood*, 9808!; Ben McDhui, 9000-9900 ft., March, *Galpin*, 6743!

DISTRIBUTION: Stockenström.

SESUTO: *Leabo*. A portion or ration.

**U. annua**, Less.

Mountain slopes and plateau. 4-15 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 342!; *Phillips in Herb. Musei Austro-Afric.*, 4675!

DISTRIBUTION: Namaqualand Minor. Worcester. Graaff Reinet. Albert. Stockenström. Orange Free State (Senekal).

SESUTO: *Sehalikane*. Derived from the verb "ho halika"—to roast. (The natives say that the plant smells like something being roasted.) The plant is incinerated, ground to a powder and mixed with fat for making an ointment, used by women and girls.

**U. brevicaulis**, Wood & Evans.

Natal, Drakensberg, 6000 ft., *Wood*, 9808.

DISTRIBUTION: Endemic.

**U. punctata**, B. & M.

Natal, Oliver's Hoek Pass, January, *Wood*, 3603.

DISTRIBUTION: Endemic.

**U. subintegrifolia**, Bolus.

Bester's Vlei, near Witzie's Hoek, 5400-6700 ft., December, *Bolus*, 8206! *Flanagan*, 1851!

DISTRIBUTION: Endemic.

LANDTIA, *Less.***L. sp. cf. L. Rüppellii**, Benth. & Hook.

Edge of streamlets, Ben McDhui, 8500-9000 ft., March, *Galpin*, 6744!

The specimen in the Bolus Collection is without flowers. Mr. Galpin notes that the "mature plants have leaves, with peduncle 12-15 in. long, fleshy, scape 2 inches, flowers yellow."

HAPLOCARPHA, *Less.***H. scaposa**, Harv.

Veld, mountain slopes and plateau. 12-30 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 55!; mountain slopes between the Mission Station and Jonathan's Village, rays yellow, common, *Phillips*, 552! Natal, Oliver's Hoek Pass, 4-5000 ft., January, *Wood*, 3595.

DISTRIBUTION: Somerset East. Aliwal North. Komgha. East Griqualand, Bechuanaland. Transvaal (Barberton, Potchefstroom, Aapies River, MacMae).



SESUTO: *Papetloane*. Derived from the verb "ho papetla"—to flatten. *Lengoako*. An orphan (so called because the stem bears a single flower). *Lisebo*. Backbitings. *Leshala*. An ember. *Liteno*. An article of a woman's toilet. The crushed leaves are used by raw native women as an article of their toilet. Also used by the witch-doctors when consulting the divining bones.

ARCTOTIS, *Linn.*

**A. stoechadifolia**, Berg.

Veld and sides of dongas. 4-25 in. high, flowers white and mauve. Spring-Summer. *A. Dieterlen*, 426!

DISTRIBUTION: Clanwilliam. Cape. Humansdorp. Prince Albert. Murraysburg. Colesberg. Aliwal North. Albert. Bechuanaland. Orange Free State (Bloemfontein, Senekal).

SESUTO: *Putsoa-pululu e kholo*. The large, grey old man.

VENIDIUM, *Less.*

**V. arctotoides**, Less.

Veld. 2-13 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 51!; Natal, Van Reenen, 5500 ft., November, *Wood*, 4688!

DISTRIBUTION: Transkei.

SESUTO: *Putsoa-pululu*. A grey old man.

**V. microcephalum**, DC.

Natal, Buffalo River, *Gerrard & McKen*, 1014, March, *Evans*, 741; Ben McDhui, 9200 ft., March, *Galpin*, 6745.

DISTRIBUTION: Worcester. Queenstown.

GAZANIA, *Gaertn.*

**G. longiscapa**, DC.

Ben McDhui, 9600 ft., March, *Galpin*, 6746!

DISTRIBUTION: Malmesbury. Cape. Queenstown. Cradock. Graaff Reinet. Aliwal North.

**G. serrulata**, DC.

Veld and mountain slopes. 2-12 in. high, flowers yellow. Spring-Autumn. *A. Dieterlen*, 160!; west slopes of plateau and Qoqolosi Peak, rays yellow, common, *Phillips*, 625! 985!

DISTRIBUTION: Natal. Bechuanaland. Transvaal (Middleburg, Vereeniging, Ermelo).

SESUTO: *Tsikilane*. Derived from the verb "ho tsikitlana"—to become stiff from cold. *Palesa e bitosa shoeshoe*. The flower is called "shoeshoe." The woolly hairs stripped from under the surface of the

leaves are rolled into threads from which the skirts, worn round the waist by young girls, are made. Formerly all the Basuto women wore these "skirts," known as "Shethana" when made up. The plant, crushed and mixed with water and put in the ears, is a native cure for ear-ache.

*Dieterlen*, 160, differs from *Phillips*, 985 (and also from the description of *G. serrulata*, DC., 'Fl. Cap.' iii, 475) in having the peduncles longer than the leaves, and the leaves glandular-setose above, but I can find no difference in the floral structure.

**G. armerioides**, DC.

Mountain slopes at Machache. Thaba-Bosin District. Flowers white. January. *A. Dieterlen*, 894!; plateau on summit of Drakensberg between Doodman's Krans and Satsanna Berg, 8750 ft., March, growing in dense tufts up to 12 in. in diameter, *Galpin*, 6747!; Wittebergen, 7-8000 ft., *Drège*!

DISTRIBUTION: Tembuland. Natal. Transvaal (Houtbosch).

SESUTO: *Shoeshoe ea lōti*. The "shoeshoe" of the high mountain.

**BERKHEYA**, Ehr.

**B. grandiflora**, Willd., var. *alternifolia*.

Slopes of Machache Mountain, Leribe District. January. *A. Dieterlen*, 893!; slopes of the Mont-aux-Sources, above the Eland's River Valley, 8000 ft., January, *Flanagan*, 1945!; Mont-aux-Sources, 8000 ft., April, *E. Dyke in Herb. Marloth*, 5435! *in Herb. Musei Austro-Afric.*, 5515!

DISTRIBUTION: Endemic.

SESUTO: *Ntsōantsāne*. Derived from the verb "ho tsōantsō"—to describe.

**B. setifera**, DC.

Mountain slopes. 2-3½ ft. high, flowers yellow. Summer. *A. Dieterlen*, 234!; mountain slopes between the Mission Station and Jonathan's Village, also at Lefi's Kloof on N.E. slopes of Leribe plateau, common, *Phillips*, 563! 841!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8211!; Eland's River Valley, near the Mont-aux-Sources, 6000 ft., December, *Flanagan*, 1957!

DISTRIBUTION: East Griqualand. Natal. Orange Free State (no locality). Transvaal (Barberton, Carolina).

SESUTO: *Leme-la-khomo*. The tongue of an ox (so called on account of the rough upper surface of the leaf). *Ntsōantsāne* (see *B. Kuntzei*, Schltr.).

**B. alba**, Phillips, sp. nov. *Suffrutex* 1-1.5 m. altus. *Rami lanati*

vel glabri. *Folia* 5·5–17 cm. longa, 2–6·5 cm. lata, obovato-oblonga, apice plus minusve truncata vel acuta, basi decurrentia, pinnati-lobata, spinosa, subtus dense lanata. *Capitulum* radiatum, 3–7 cm. latum. *Bractee* involucrae, apice spinosae, subtus dense albo-tomentosae. *Corolla* radii alba, 2·5 cm. longa, 4·5 mm. lata, oblongo-linearis, apice 4-dentata, subtus paullo glanduloso-pubescent. *Corolla* disci 8 mm. longa, supra cylindrata, paullo glandulosa. *Pappus* coroniformis; squamae 5 mm. longae. *Ovarium* 2 mm. longum, glabrum; stylus 9 mm. longus, filiformis, pubescens; lobi 2 mm. longi, lineares, apice obtusi, pubescentes. *Fructus* 4 mm. longus, 4-gonus, glaber.

Slopes of Qoqolosi Peak on plateau above the Mission Station, January–February, A. Dieterlen, 940, Phillips, 981.

DISTRIBUTION: Endemic.

SESUTO: *Ntsöantsäne e tsoen*. 'The white "Ntsöantsäne." *Mohata o mosoeu*. 'The white "Mohata." Used as a charm for procuring things wished for.

A bush, 3–4 ft. high. *Branches* angular, cobwebby, becoming more or less terete and glabrous above. *Leaves* 5·5–17 cm. long, 2–6·5 cm. broad, obovate-oblong in outline, more or less truncate or acute at the apex, decurrent at the base, pinnati-lobed, the main nerve and the lateral nerves excurrent into yellow pungent spines 7–1 cm. long, glabrous or faintly cobwebby above, densely clothed with white felt beneath. *Inflorescence* 3–7 cm. in diameter, in a loose leafy panicle at the end of the branches. *Outer involucral bracts* up to 3 cm. long, produced into a long pungent spine, entire, with a few marginal spines, faintly cobwebby above and densely albo-tomentose beneath. *Receptacle* 1·6 cm. in diameter, convex, honeycombed; the edges of the membranous cups fimbriated and produced into long hairs. *Ray-florets* neuter. *Corolla* white, 2·5 cm. long, 4·5 mm. broad, oblong-linear, 4-toothed at the apex, narrowed and tubular at the base, 9-nerved, sparsely glandular pubescent without. *Disc-florets* hermaphrodite. *Corolla* yellow, 8 mm. long, cylindric above, narrowed in the lowermost third, sparsely glandular; corolla lobes 4 mm. long, linear, obtuse. *Stamens* inserted about half-way down the corolla-tube; filaments 1 mm. long, filiform; anthers 5·5 mm. long, linear, with a lanceolate obtuse gland at the apex, sagittate at the base. *Pappus* a crown of acute scales, 5 mm. long. *Ovary* 2 mm. long, oblong in outline, glabrous; style 9 mm. long, filiform, slightly swollen at the base, finely pubescent; lobes 2 mm. long, linear, very slightly broadened above, obtuse, finely pubescent. *Fruit* 4 mm. long, 4-angled, glabrous, crowned with the persistent pappus.

Differs from all other species of *Berkheya* by having white flowers.

**B. bilabiata**, N. E. Br.

Natal, in a valley near Van Reenen's Pass, 5-6000 ft., March, *Wood*, 5605.

DISTRIBUTION: Endemic.

**B. latifolia**, Wood & Evans.

Natal, side of hill between Van Reenen and De Beer's Pass, June, *Wood*, 5960.

DISTRIBUTION: Endemic.

**B. Kuntzeii**, O. Hoffm.

Mountain slopes and ravine. 10-25 in high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 44! 891!; ravine on west slopes of Leribe plateau, flowers yellow, *Phillips*, 575!

DISTRIBUTION: Aliwal North.

SESUTO: *Ntsöantsäne*. Derived from the verb "ho-tsöantso"—to describe. *Sehlohlo se seholo*. The big "sehlohlo." Used as a decoction in illness to pacify a nervous patient. The young leaves are cooked and eaten as a vegetable.

**B. Evansii**, Schltr.

Natal, Drakensberg, 6000 ft., February, *Evans*, 611.

DISTRIBUTION: Endemic.

**B. montana**, Wood & Evans.

Mountain slopes. 25-40 in. high, flowers yellow. Autumn. Malavaneng, Leribe District, *A. Dieterlen*, 843!; Natal, summit of the Drakensberg, near Van Reenen, *Wood*, 5605; between Van Reenen and De Beer's Pass, March, *Wood*, 6978.

DISTRIBUTION: Endemic.

SESUTO: *Mohatollo*. He who relieves. A lotion for bruises is prepared from the roots.

**B. (Stobaea cirsiifolia, DC.)**

Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8209!; Doodman's Krans Mtn., 8800 ft., March, *Galpin*, 6753!; near Buffalo River Waterfall, Basutoland, 8100 ft., March, *Galpin*, 6752!; Wittebergen, 6-7000 ft., *Drège*!

DISTRIBUTION: Endemic.

**B. (S. onopordifolia, DC.)**

Veld. 12-35 in. high, flowers bright yellow. Summer-Autumn. *A. Dieterlen*, 627!

DISTRIBUTION: Beaufort West. Orange Free State (Bloemfontein). Transvaal (Standerton).

**SESUTO:** *Mohato*. Derived from the verb “ho hats” —to oppress. Used as a charm to detect an evildoer and prevent him from doing harm. The native doctors use the plant in many feverish illnesses. Together with *Euphorbia basutica* it is said by the natives to cure leprosy.

**B. (*S. multijuga*, DC.)**

Slopes of high mountains. 25–40 in. high, flowers yellow. Summer. *A. Dieterlen*, 864!; summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2199! 2119! (Flanagan distributed the plant under both these numbers); Doodman’s Krans Mtn., 8800 ft., March, *Galpin*, 6751!

**DISTRIBUTION:** East Griqualand.

**SESUTO:** *Ntsantsane ea liti*. The “Ntsantsane” of the high mountain.

**B. (*S. aristosa*, DC.)**

High mountain slopes. 20–32 in. high, flowers yellow, December, *A. Dieterlen*, 863!; Natal, Tabanhlope, 6000 ft., October, flowers yellow, *Wood*, 10640!; summit of Pot River Berg, 5800 ft., March, *Galpin*, 6750!

**DISTRIBUTION:** Tembuland. East Griqualand.

**SESUTO:** *Papetloane e mentloa*. The prickly “Papetloane.”

**STEPHANOCOMA, Less.**

**S. carduoides, Less.**

Hillsides, Maclear, besides streamlets, 4700 ft., March, *Galpin*, 6749.

**DISTRIBUTION:** George. Somerset East. Komgha. East Griqualand.

**CNICUS, Linn.**

**C. lanceolatus, Willd.**

Roadsides and round villages. 1–3 ft. high, flowers violet. Autumn. Morija. *A. Dieterlen*, 499!; ravine between the Mission Station and Jonathan’s Village, growing under a rock-shelter where cattle sleep, flowers pink, *Phillips*, 759!

**DISTRIBUTION:** An introduced weed.

**SESUTO:** *Ntsantsane*. Derived from the verb “ho tsoantsa” —to draw or depict. Said to have been introduced from the Cape Colony in forage used for the horses of the troops during the “Gun War” of 1880.



## DICOMA, Cass.

**D. macrocephala**, DC.

Natal, upper Tugela. 4-5000 ft., January, rare, *Wood*, 3618.

DISTRIBUTION: Orange Free State (Bloemhof). Transvaal (Waterburg).

**D. anomala**, Sond.

Veld and mountain slopes. 4-20 in. high, flowers mauve. Autumn. *A. Dieterlen*, 58!; slopes between the Mission Station and Jonathan's Village, and on west slopes of Leribe plateau, a creeper growing under rocks, flowers pinkish, *Phillips*, 572! 715!; banks Klein Pot River, Maclear District, 4550 ft., March, *Galpin*, 6754.

DISTRIBUTION: Albany. Aliwal North. Stutterheim. Natal. Orange Free State (Bloemfontein). Transvaal (Potchefstroom, Johannesburg, Rustenburg, Aapie's River).

SESUTO: *Kloenya*. To change colour or to blush. Used as a medicine for colic and toothache.

var. **cirsioides**.

Natal, Drakensberg, 5-6000 ft., *Wood*, 3596.

DISTRIBUTION: Transvaal (Wonderboompoort, Aapie's River).

## GERBERA, Gron.

**G. piloselloides**, Cass.

Veld and mountain slopes. 4-20 in. high, flowers pale yellow. Spring-Summer. *A. Dieterlen*, 153! 518!; Natal. Van Reenen, 5-6000 ft., November, *Wood*, 4772.

DISTRIBUTION: Cape. Uitenhage. Stockenström. King William's Town. Komgha. Tembuland. East Griqualand.

SESUTO: *Mothuntsetso*. He who makes smoke rise. *Tsèbè ea pela*. The rock-rabbit's ear. The plant is used to fumigate the hut of a person suffering with a cold in the head.

**G. ambigua**, Sch. Bip.

Mont-aux-Sources, *A. Bolus in Herb. Guthrie*, 4859!; Natal, Mooi River District, 4-5000 ft., October, *Wood*, 5469.

DISTRIBUTION: Port Elizabeth. Albany. East Griqualand. Natal. Transvaal (Germiston).

**G. viridifolia**, Sch. Bip.

Veld and mountain slopes. 10-25 in. high, flowers white. Spring-Autumn. *A. Dieterlen*, 168!

DISTRIBUTION: Albany. Komgha. Transkei. East Griqualand. Natal. Transvaal (Pretoria, Barberton).

SESUTO: *Moarubetso*. He who fumigates. *Ripa-lithata*. Cutting hard things. *Seboko*. An assembly. The smoke from a burning plant is inhaled as a cure for cold in the head.

**G. natalensis**, Sch. Bip.

Natal, Polela, 5-6000 ft., July, *Evans*, 515.

DISTRIBUTION: Natal.

This name in the 'Flora Capensis' is sunk under *G. viridifolia*, but Wood in his list of Natal Plants keeps them separate.

**G. Kraussii**, Sch. Bip.

Bester's Vlei, near Witzie's Hoek, 5900 ft., December, *Bolus*, 8210 !

DISTRIBUTION: Transkei. Natal. Swaziland. Transvaal (Barberton).

**G. parva**, N. E. Br. (= *G. alticola*, Bolus).

Summit of the Mont-aux-Sources, c. 10,000 ft., October. *G. Mann in Herb. Marloth*, 2879 !; Natal, Giant's Castle, c. 9000 ft., November, *A Bolus in Herb. Bolus* !; Drakensberg Mtns., 6500 ft., July, *Evans*, 57.

DISTRIBUTION: Endemic.

**G. sp.**

Natal. Bushman's River Pass, 10-12,000 ft., December, *Thode*.

DISTRIBUTION: Endemic.

## HIERACIUM, Linn.

**H. capense**, Linn.

Veld, mountain slopes, and plateau. 10-25 in. high, flowers yellow. Spring-Autumn. *A. Dieterlen*, 293 !; common in various places round the Leribe plateau. *Phillips*, 545 ! 546 ! 562 ! 834 ! 866 !

DISTRIBUTION: Cape. Graaff Reinet. Transkei. Natal. Transvaal (Belfast).

SESUTO: *Fukuthoane*. Meaning unknown. Used as a vegetable in the young state.

var. **microcephala**.

Natal, Upper Tugela, 4-5000 ft., January, *Wood*, 3629.

DISTRIBUTION: Buggersdorp. Aliwal North.

## CREPIS, Linn.

**C. polyodon**, Phillips, comb. nov. (Pl. VI, fig. 3). *Planta* acaulescens. *Folia* radicalia, 3-12 cm. longa, 3-2 cm. lata, linearia, lanceolato-linearia vel oblanceolato-oblonga, apice acuta vel rotunda, basi

angustata, paullo pubescentia aliquando glabra; margines dentatae vel incisae. *Pedunculus* simplex vel supra aliquando basi aliquando ramis diffundus, sulcatus, glanduloso-pubescent vel glaber. *Capitula* 1·1–2 cm. longa, 1·2 cm. lata. *Bracteae* ·6–2 cm. longa, lineares, apice subacutae, glabra vel glanduloso-pubescentes. *Bracteae-involucrae* 1·2 cm. longae, 2·5–3 mm. latae, ovato-lineares, apice subtruncatae, concavae, subtus glandulosae; margines membranaceae. *Tubus corollae* 4 mm. longus, ·5 mm. latus, cylindratus, glaber; limbus 6·5 mm. longus, 1·5 mm. latus, linearis, apice truncatus, 3-dentatus. *Filamenta* 1·5 mm. longa; antherae 4 mm. longae, lineares, basi sagittatae. *Pappus* 7 mm. longus, barbellatus. *Ovarium* 1·5–4 mm. longum, ·5 mm. latum, lineare, supra angustatum; stylus 1 cm. longus, supra pubescens. *Fructus* ·9–1 cm. longus, supra attenuatus, 10-costatus, pubescens.

Philipstown and Katrivier, October, *Ecklon*; Basutoland, veld and mountain slopes. 5–20 in. high, flowers yellow. Spring. *A. Dieterlen*, 500; Komgha, 2000 ft., December, *Flanagan*, 895; East Griqualand, round Kokstad, 5000 ft., October–December, *Tyson*, 1097, 1588, *Tyson in Herb. Norm. Austro-Afric.*, 467; Transvaal (Saddleback Mtn., Barberton), 4–4500 ft., September, *Galpin*, 1027.

An acaulescent plant with a thick woody subterranean stem, simple or sometimes branched below the ground. *Leaves* radical, 3–12 cm. long, ·3–2 cm. broad, linear, lanceolate-linear or oblanceolate-oblong, acute or rounded at the apex, narrowed at the base, entire or with toothed or incised margins, sparsely pubescent, sometimes almost glabrous. *Peduncles* 1–3 to each stem, simple or branched above, sometimes branched almost at the base, ribbed, glandular-pubescent to almost glabrous. *Capitula* 1–10 to each peduncle, when more than one then arranged in a racemose manner on the peduncle, 1·1–2 cm. long, 1–2 cm. in diameter, ovate in outline. *Bracts* ·6–2 cm. long, linear, subacute, glabrous or pubescent with gland-tipped hairs. *Involucre* 2-seriate, bracteolate at the base with 3–6 linear glandular bracts. *Involucral bracts* 1–2 cm. long, 2·5–3 mm. broad, ovate-linear, almost truncate at the apex, concave, glandular on the keel beneath, with membranous margins. *Receptacle* flat, nude. *Corolla-tube* 4 mm. long, ·5 mm. broad, cylindric, glabrous; limb 6·5 mm. long, 1·5 mm. broad, linear, truncate and 5-toothed at the apex. *Filaments* 1·5 mm. long; anthers 4 mm. long, linear, with an ovate obtuse gland at the apex, tailed at the base. *Pappus* 7 mm. long, barbellate. *Ovary* 1·5–4 mm. long, ·5 mm. broad, linear in outline, narrowed above and expanded into a disc bearing the pappus (when young the ovary is oblong and not produced into a distinct neck); style 1 cm. long, fili-

form, terete, pubescent in the uppermost third; lobes 1·5 mm. long, terete, pubescent. *Fruit* 9–1 cm. long, semiterete, narrowed above, 10-ribbed, minutely pubescent. "*Hieracium capense*, Fries. *Epic. Hier.*, p. 67; *Flora Capensis*, iii, 530.

This is described in the 'Flora Capensis' as a *Hieracium*, but the character of the fruit would remove it from this genus to *Crepis* as first pointed out by the late Dr. Bolus in manuscript. Mr. Galpin notes on his ticket "Klatt reported this as *Hypochaeris glabra*, Linn."; the nude receptacle, however, would remove it from this genus. Specimens were distributed as *Crepis polyodon*, Bolus, in the *Herb. Norm. Austro-Afric.*, No. 467.

### LACTUCA, Linn.

#### *L. capensis*, Thunb.

Veld and mountain slopes. 5–24 in. high, flowers white. Spring–Autumn. *A. Dieterlen*, 25!; Lefi's Kloof, on N.E. slopes of Leribe plateau, *Phillips*, 840!; south slopes of Leribe plateau above Khaniane, *Phillips*, 882!

DISTRIBUTION: Cape. Port Elizabeth. Graaff Reinet. Molteno. Albert. Komgha. Natal. Transvaal (Rustenburg, Potchefstroom, Pretoria).

SESUTO: *Kholoboto* and *Lekoloboto*. Meanings unknown. Eaten as a vegetable when young.

### SONCHUS, Linn.

#### *S. ecklonianus*, DC.

Veld and mountain slopes. 3–20 in. high, flowers yellow. *A. Dieterlen*, 571!

DISTRIBUTION: Natal.

SESUTO: *Leharasvana*. The ragged one. Cooked as a vegetable in the young state.

#### *S. integrifolius*, Harv.

Veld and mountain slopes. 4–15 in. high, flowers yellow. Summer. *A. Dieterlen*, 155!

DISTRIBUTION: Komgha. East Griqualand. Natal. Transvaal (Pretoria, Volksrust).

SESUTO: *Naka la tholo*. The horn of the eland. *Sethökōyane se seholo*. The big "sethökōyane." Used as a vegetable in the young state.

**S. nanus**, Sond.

Veld and mountain slopes. 1-3 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 34!

DISTRIBUTION: Endemic?

SESUTO: *Sethōkōyane*. Meaning unknown. One of the first spring plants, and very much liked by the natives as a vegetable.

**S. oleraceus**, Linn.

Mountain slopes and river banks. 6-36 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 120! 673!

DISTRIBUTION: Cape. Graaff Reinet. Komgha. Natal.

SESUTO: *Leshabe*. Derived from the verb "ho-shaba"—to eat with (bread or other food). *Bono-sa-lekhoaba*. The tail of the crow. Very much appreciated as a vegetable by the natives, who eat the cooked plant with bread.

## CAMPANULACEAE.

## LOBELIA, Linn.

**L. Preslii**, A. DC.

Mountain slopes at Malavaneng, Leribe District, flowers blue and purple. January. *A. Dieterlen*, 933!; Natal, Mawahqua Mountain, 6-7000 ft., April, *Wood*, 4620; Ben McDhui and Doodman's Krans Mountain, 9500-9800 ft., March, *Galpin*, 6755.

DISTRIBUTION: Murraysburg. Tembuland. East Griqualand.

SESUTO: *Mahlo a Konyana a lōti*. The "Mahlo a Konyana" of the high mountain.

**L. decipiens**, Sond.

Damp spots on mountain slopes. 6-15 in. high, flowers blue and dark violet. Summer. *A. Dieterlen*, 414!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8213! *Flanagan*, 1889!; Drakensbergen, 7000 ft., *A. Bolus in Herb. Guthrie*, 4865!

DISTRIBUTION: Swellendam. Uitenhage. Albany. King William's Town. Komgha. Transkei. Natal. Zululand. Transvaal (Magaliesberg).

SESUTO: *Mahlo a Konyana*. Lambs' eyes (so called on account of the fine colour and softness of the flowers).

**L. Erinus**, Linn.

Damp spots on veld and mountain slopes. 5-15 in. high, flowers white and sky blue. Summer-Autumn. *A. Dieterlen*, 253!

DISTRIBUTION: Natal.



SESUTO: *Moroho oa likonyana*. The vegetable of the lambs. The plant is said to be liked by sheep.

**L. natalensis**, A. DC.

Natal, Upper Tugela, 4-5000 ft., January, *Wood*, 3458.

DISTRIBUTION: Delagoa Bay.

var. **subulifolia**.

Mountain slopes at Malavaneng, Leribe District. 8-16 in. high, flowers blue or pinkish. January. *A. Dieterlen*, 955! 965!

DISTRIBUTION: Natal.

SESUTO: *Mohlo a Konyana*. Lambs' eyes. *Malan'a Konyana*. The intestines of a lamb.

The above species and variety, I think, are only forms of *L. Erinus*, Linn.

**L. dregeana**, A. DC.

Damp spots on veld. 1-3 in. high, flowers white. Summer. *A. Dieterlen*, 461!; Wittebergen, 6-7000 ft., *Drège*!

DISTRIBUTION: East Griqualand. Natal. Transvaal (Vaal River).

SESUTO: *Napshane ea phiri*. The "Napshane" of the wolf. This plant is very much used by the witch-doctors, who make a preparation from it in which they wash their divining bones, believing that it makes them more accurate.

**L. (Metzleria) dregeana**, Sond.).

Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*!; Wittebergen, 6-7000 ft., *Drège*.

DISTRIBUTION: East Griqualand. Natal. Transvaal (near Hebron).

**L. aquatica**, Phillips, sp. nov. (Pl. III, fig. c). *Herba* aquatica. *Rhizomata* parva. *Folia* 5-2.2 cm. longa, supra 3-6 mm. lata, obovata vel obovato-elliptica, apice obtusa, basi attenuata, glabra. *Petiolus* 3-8 mm. longus, planus. *Pedicellus* 3 mm. longus, teres, glaber. *Calyx* 2.75 mm. longus; segmenta 1.25 mm. longa, ovato-elliptica, apice subacuta, glabra. *Tubus* corollae 4 mm. longus, 4.5 mm. latus, glaber; lobi 3.5 et 4 mm. longi, 1 et 2 mm. lati, oblongi, elliptico-oblongi, vel oblongo-lineares, apice acuti, glabri. *Filamenta* 4 mm. longa, plana, glabra; antherae 1.75 mm. longae, 2 inferiores setosae. *Ovarium* 1.5 mm. longum, ovatum, glabrum; stylus 3.5 mm. longus, teres; stigma minutum, conicum, ciliatum.

In a marsh at the base of Doodman's Krans Mountain, Drakensbergen, 8500 ft., March, *Galpin*, 6756. Flowers purple.

A small marsh herb with creeping stems rooting at the nodes. *Leaves* .5-2.2 cm. long, 3-6 mm. broad above, obovate or obovate-elliptic, obtuse, narrowed at the base into a flattish petiole 3-8 mm. long, glabrous. *Flowers* solitary in the axils of the leaves, pedicelled. *Pedicel* 3 mm. long, terete, glabrous. *Calyx* 2.75 mm. long, cut almost to the base; lobes 1.25 mm. long, ovate-elliptic, subacute, glabrous. *Corolla-tube* 4 mm. long, 4.5 mm. broad when flattened out, glabrous; larger lobes 3.5 mm. long, 2 mm. broad, oblong or elliptic-oblong, acute, glabrous; smaller lobes 4 mm. long, 1 mm. broad, oblong or oblong-linear, acute, glabrous. *Stamens* monadelphous; filaments 4 mm. long, flat, glabrous; anthers 1.75 mm. long, the lower two with a few setose hairs. *Ovary* 1.5 mm. long, ovate in outline, glabrous; style 3.5 mm. long, terete; stigma minute, conical, with a ring of fine hairs.

In habit this plant resembles *L. muscoides*, Cham., to which it is allied, but differs in having entire leaves.

**L. Tysonii**, Phillips, sp. nov. (Pl. I, fig. A). *Herba* acaulescens. *Folia* radicalia, .8-9.5 cm. longa, .2-2.6 cm. lata, obovata, lanceolata vel elliptica, apice obtusa, basi angustata, glabra. *Pedunculus* 7-46.5 cm. longus, glaber. *Bracteae* 1.5-3 mm. longae, lineares. *Pedicellus* .6-1.2 cm. longus. *Tubus* calycis 3.7 mm. longus, glaber; lobi 2-4 mm. longi, lineares, apice subacuti. *Tubus* corollae 5 mm. longus, 4 mm. latus; lobi 3-6.5 mm. longi, obovati, glabri. *Filamenta* 6 mm. longa, glabra; antherae 2 mm. longae. *Ovarium* 1-3 mm. longum, glabrum; stylus 4 mm. longus, teres, glaber; lobi .5 mm. longi, oblongi. *Fructus* 8 mm. longus, 3.5 mm. latus, 5-costatus, glaber.

Banks of the Hlotse River, 3-12 in. high, flowers mauve. Spring (October). Makokoane, Leribe District, A. Dieterlen, 811; East Griqualand, grassy places near Kokstad, 5000 ft., November, Tyson, 1889, *Tyson in Herb. Norm. Austro-Afric.*, 571.

SESUTO: *Poli ea nōka*.

A herbaceous plant with radical leaves and long subnude peduncles arising from the rootstock. *Peduncles* glabrous, naked except for 1 or 2 pairs of leaves near the base. *Radical leaves* .8-9.5 cm. long, .2-2.6 cm. broad, obovate, lanceolate or elliptic, obtuse, narrowed at the base into a flattened petiole, entire or remotely serrulate, glabrous. *Inflorescence* racemose. *Bracts* 1.5-3 mm. long, linear. *Pedicels* .6-1.2 cm. long, elongating in the fruit up to 3.5 cm. *Calyx-tube* 3.7 mm. long, turbinate, sometimes obovate in outline, glabrous; lobes 2-4 mm. long, linear, subacute. *Corolla-tube* 5 mm. long, 4 mm. broad

when laid open, glabrous; upper lobes 6·5 mm. long, 3–4 mm. broad, obovate, obtuse, narrowed at the base; lower lobes 3 mm. long, obovate, bluntly apiculate, narrowed at the base. *Staminal column* 6 mm. high; filaments linear, glabrous; anthers 2 mm. long, the 2 shortest bearded at the apex. *Ovary* 1–3 mm. long, glabrous; style 4 mm. long, terete, glabrous; lobes, 5 mm. long, oblong, with a circle of hairs at the base. *Fruit* 8 mm. long, 3·5 mm. broad, 2-celled, 5-ribbed, glabrous. Approaches *L. cyphoides*, Harv., from which it differs in having glabrous leaves, longer pedicels, and the calyx-tube being longer than the lobes.

CYPHIA, Berg.

*C. corylifolia*, Harv.

Natal, Van Reenen, 5–6000 ft., February, Wood, 9203.

DISTRIBUTION: Natal.

*C. elata*, Harv.

Mountain slopes and plateau. 12–25 in. high, flowers pale mauve. Summer. *A. Dieterlen*, 451; higher grassy slopes of the Mont-aux-Sources, c. 8100 ft., January, Thode, 31.

SESUTO: Lenkoto.

*C. triphylla*, Phillips, sp. nov. *Scandens*, 5–1 m. longus. *Rami* glabri. *Folia* subsessilia, trifoliolata. *Petiolus* 1 mm. longus, linearis: foliola 1–3 cm. longa, 5–1 mm. lata, linearia, apice obtusa, glabra. *Inflorescentia* terminalis, 7–20 cm. longa. *Pedicellus* 2 mm. longus, teres, glaber. *Tubus* calycis 1 mm. longus, campanulatus, glaber; lobi 1·5 mm. longi, lineares, apice acuti, marginati. *Segmenta* corollae 6–7 mm. longa, lanceolata lineariaque. *Filamenta* 3·5 mm. longa, supra angustata, basi paullo plana, glabra: antherae 1·5 mm. longae, lineares, glabrae. *Ovarium* 2·5 mm. longum, ovatum, glabrum; stylus 1·5 mm. longus, teres; stigma capitatum, ciliatum.

Slopes at Malavaneng, Leribe District. Summer (February). *A. Dieterlen*, 945.

DISTRIBUTION: Endemic.

SESUTO: *Lekotoana la mehlaka*. The small "Lekoto" of the marshes. *Mararana oa mehlaka*. The small creeper of the marshes.

A twining plant, 5–1 m. long. *Stems* glabrous. *Leaves* shortly petioled, trifoliate. *Petiole* 1 mm. long, linear; leaflets 1–3 cm. long, 5–1 mm. broad, linear, obtuse, glabrous. *Inflorescence* terminal, 7–20 cm. long, leafless. *Pedicels* 2 mm. long, slender, terete, glabrous. *Calyx-tube* 1 mm. long, campanulate, glabrous; lobes 1·5 mm. long, linear, acute, with narrow membranous wings. *Corolla-segments* 6–7 mm. long; the lower lanceolate, attenuate at the base; the upper

linear, channelled. *Stamens* alternating with the corolla segments; filaments 3.5 mm. long, narrow above, slightly widened towards the base, glabrous; anthers 1.5 mm. long, linear, glabrous. *Ovary* 2.5 mm. long, ovate in outline, glabrous; style 1.5 mm long, terete; stigma capitate, fringed with hairs.

Very near *C. digitata*, Willd., from which it is distinguished by having glabrous stamens.

**C. sp.**

Natal, climbing over shrubs at Polela, 5-6000 ft., April, Wood, 4569.

LIGHTFOOTIA, *L'Her.*

**L. Huttoni**, Sond.

Natal, Van Reenen, 5-6000 ft., January, Wood, 8800.

DISTRIBUTION: Stockenstrom. Transkei. East Griqualand. Natal. Swaziland.

**var.**

Natal, Mawahqua, 6-7000 ft., April, Wood, 4599.

DISTRIBUTION: Endemic.

**L. denticulata**, Sond.

Hills and mountain slopes. 2-8 in. high, flowers dark violet. Summer. *A. Dieterlen*, 332!; Caledon River, *Burke*.

DISTRIBUTION: Uitenhage. Natal. Transvaal.

SESUTO: *Boloa*. A love philter. A decoction is made from the plant with which women, especially the wives of polygamists, bathe themselves, believing that by so doing they will be loved by their husbands.

**L. albens**, Spreng.

Mountain slopes. 1-3 ft. high, flowers yellow. Summer. *A. Dieterlen*, 402!

DISTRIBUTION: Caledon. Uitenhage. Komgha. Orange Free State (Orange River).

SESUTO: *Tloatlvoatsane*. Derived from the verb "ho tloatlvoatsa"—to crack or make a noise. Used as fuel.

**L. Dieterlenii**, Phillips, sp. nov. *Planta* 10-32 cm. alta. *Rami* pubescentes. *Folia* erecta, 4-1.5 cm. longa, 5-2.5 mm. lata, linearia vel ovato-linearia, apice obtusa, basi semiamplexicaulia, subtus uncostata, glabra; margines recurvae, dentatae. *Flores* axillares vel terminales. *Pedicellus* ad 1.5 mm. longus. *Tubus calyci* 1-2 mm.

longus, campanulatus, 10-costatus, 5-angulatus, glaber; lobi 2-3 mm. longi, lineares vel ovato-lineares, acuminati, apice subacuti, glabri; margines cartilaginae, integrae vel 1-4-dentatae. *Tubus corollae* 1.5-2 mm. longus, glaber; lobi 5-6 mm. longi, 1-1.25 mm. lati, lineares, apice subacuti, glabri. *Filamenta* 1.5-2 mm. longa, basi ovata vel orbiculata et ciliata, supra filiformia; antherae 1.75-2.5 mm. longae, lineares. *Ovarium* 1.5-2 mm. longum, subglobosum; stylus 5-6 mm. longus, teres, apice trilobatus.

Veld, mountain slopes and plateau. 4-18 in. high. Summer-Autumn. Flowers violet. *A. Dieterlen*, 528; Orange Free State, Harrismith, near the Wilge River, February, *Wood*, 4815; Transvaal, Witwatersrand, April, *Mrs. Hutton in Herb. Albany Museum*, 881.

A small shrub 10-23 cm. high, with simple branches arising from the apex of a thick underground stem, rarely branched above. *Branches* terete, pubescent. *Leaves* erect, 4-1.5 cm. long, .5-2.5 mm. broad below, linear or ovate-linear, obtuse, half-clasping at the base, with recurved and denticulate margins and a distinct midrib beneath, glabrous. *Flowers* axillary or terminating very short lateral shoots. *Pedicel* up to 1.5 mm. long, elongating slightly in the fruit. *Calyx-tube* 1-2 mm. long, campanulate, 10-nerved, 5-angled, glabrous; lobes 2-3 mm. long, linear or ovate-linear, acuminate, subacute, longer than the tube, with cartilaginous margins, entire or 1-4-toothed, glabrous. *Corolla-tube* 1.5-2 mm. long, glabrous; lobes 5-6 mm. long, 1-1.25 mm. broad, linear, subacute, glabrous. *Stamens* inserted at the base of the corolla-tube; filaments 1.5-2 mm. long, ovate or orbicular and ciliate below, filiform above; anthers 1.75-2.5 mm. long, linear. *Ovary* enclosed in the calyx-tube, 1.5-2 mm. long, subglobose, 3-celled; style 5-6 mm. long, terete, usually thickened above, glabrous; stigmas three, 1 mm. long, linear or oblong.

Near *L. Huttoni*, Sond., and *L. unidentata*, Sond.; from the former it differs in having toothed leaves and from the latter it may be distinguished by having a glabrous calyx and corolla.

#### WAHLENBERGIA, *Schrad.*

##### **W. montana**, A. DC.

Natal, near the Tugela Falls, 5000 ft., *Wood*, 3613; Ben McDhui, 9250-9800 ft., March, *Galpin*, 6762.

DISTRIBUTION: Stockenström. East Griqualand.

##### **W. Banksiana**, A. DC.

Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8212.

DISTRIBUTION: Cape.



**W. capillacea**, A. DC.

Basutoland, valley above the Buffalo River Waterfall, c. 8200 ft., March, flowers blue, *Galpin*, 6759; Natal, Polela, 5000 ft., *Wood*, 4604.

DISTRIBUTION: Knysna. Uitenhage. Port Elizabeth. Albany. East Griqualand.

**W. denudata**, A. DC.

Mountain slopes. 10–25 in. high, flowers violet or lilac. Summer. *A. Dieterlen*, 119c! 119d!

DISTRIBUTION: East Griqualand.

SESUTO: *Tenane*. See *W. androsacea*.

**W. undulata**, A. DC.

Mountain slopes. 12–25 in. high, flowers violet. Summer. *A. Dieterlen*, 119a!; Tsitsa Footpath, Drakensberg, 7600 ft., March, *Galpin*, 6757.

DISTRIBUTION: Swellendam. Uitenhage. Albany. Alice. Komgha. East Griqualand.

SESUTO: *Moopetsane*. Derived from the verb “ho opa”—to clap the hands. *Letoao*. Meaning unknown. *Tenane*. See *W. androsacea*.

**W. caledonica**, Sond.

Mountain slopes. 10–22 in. high, flowers violet. Summer. *A. Dieterlen*, 119b!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1859!; Caledon River, *Burke*.

DISTRIBUTION: Endemic.

SESUTO: *Tenane*. See *W. androsacea*.

**W. Zeyheri**, E. & Z.

Veld and mountain slopes. 6–15 in. high, flowers bluish-mauve. Summer. *A. Dieterlen*, 119e!; Natal, grassy hill, Polela, 5–6000 ft., *Wood*.

DISTRIBUTION: Komgha. East Griqualand.

SESUTO: *Tenane*. See *W. androsacea*.

**W. androsacea**, A. DC.

Veld and in cultivated lands. 8–20 in. high, flowers mauve. Spring-Summer. *A. Dieterlen*, 340!; Basutoland, without precise locality, *Kolbe in Herb. Bolus*!

DISTRIBUTION: Natal. Griqualand West. Orange Free State. Transvaal. Lourenco-Marques.

SESUTO: *Tenane*. Derived from the verb “ho tena”—to get tired of. Used in the form of a decoction for ulcers in the intestines of

children. This is one of the first spring plants and grows in quantities in the lands before ploughing has begun. Women and girls are seen every day collecting the plant, which they cook as a spinach, but they soon tire of it.

**W. depressa**, Wood & Evans. (Pl. III, fig. B).

Under rocks on plateau. 4–12 in. high, flowers light-blue. Summer. *A. Dieterlen*, 529!; Natal, wet rocks on the summit of the Drakensberg, March, *Wood*, 5977.

DISTRIBUTION: Endemic.

SESUTO: *Bolaoane*. The small love-philter. *Boea ba 'mutla*. The hair of a hare. Young men, wishing to win the love of girls who refuse to be courted, wash themselves with a decoction prepared from the plant.

**W. depressa**, W. & E. forma (Pl. V, fig. 4).

Plateau and mountain slopes. 2–5 in. high, flowers white or pale. Summer. *A. Dieterlen*, 413!; forming mats, flowers pale blue, *Phillips*, 901!

DISTRIBUTION: Endemic.

SESUTO: *Moriri oa letlapa*.

In habit the above specimens are totally different from the typical form. Numerous compact slender branches arise from the apex of an underground woody stem arranged in such a way as to form cushions.

**W. basutica**, Phillips, sp. nov. (Pl. V, fig. 3). *Planta* prostrata. *Rami* 4–10 cm. longi; *ramuli* pilosi. *Folia* 4–1 cm. longa, 1·5–5 mm. lata, elliptica, obovata, spathulata vel subrotunda, apice obtusa, basi attenuata, aliquando pilosa; *margines* integrae, crassae. *Flores* terminales, solitarii. *Pedicellus* ad 3·5 mm. longus, pilosus. *Tubus calycis* 3 mm. longus, supra 4 mm. latus, pilosus; *lobi* 4–5 mm. longi, basi 2 mm. lati, ovati, apice acuti, paullo pilosi; *margines* crassae. *Corolla* paullo pilosa; *tubus* 8 mm. longus, supra 5 mm. latus, campanulatus; *lobi* 6 mm. longi, 4 mm. lati, elliptici, apice mucronati ciliatique. *Filamenta* 3 mm. longa, lineari-acuminata; *antherae* 2·5 mm. longae lineares. *Ovarium* 2 mm. longum, circiter 2 mm. latum, subglobosum; *stylus* 8 mm. longus, teres, infra minute pubescens, apice truncatus, trilobatusque; *lobi* 5 mm. longi.

Mountain slopes and plateau. 2–8 in. long, flowers pale blue. Spring. *A. Dieterlen*, 622.

DISTRIBUTION: Endemic.

SESUTO: *Mafôle*.

A prostrate plant with creeping branches 4–10 cm. long. *Branches* compact, forming tufts; *branchlets* pilose. *Leaves* 4–1 cm. long,

1·5–5 mm. broad, elliptic, obovate, spatulate or subrotund, obtuse, attenuated at the base into a flat petiole, entire, with rounded and thickened margins, sometimes pilose, otherwise glabrous. *Flowers* terminal, solitary. *Pedicels* up to 3·5 mm. long, pilose, sometimes almost absent. *Calyx-tube* 3 mm. long, 4 mm. in diameter above, obconical, pilose; lobes 4·5 mm. long, 2 mm. broad at the base, triangular-ovate, acute, with rounded and thickened margins, scantily pilose. *Corolla* pale blue, scantily pilose; tube 8 mm. long, 5 mm. in diameter above, campanulate; lobes 6 mm. long, 4 mm. broad, elliptic, bluntly mucronate at the apex and ciliate with a few hairs. *Stamens* inserted at the base of the corolla-tube; filaments 3 mm. long, linear-acuminate; anthers 2·5 mm. long, linear. *Ovary* 3-celled, 2 mm. long, about 2 mm. broad, subglobose; style 8 mm. long, terete, minutely pubescent on the lower half, truncate and 3-lobed at the apex; lobes ·5 mm. long, linear, terete. *Fruit* enclosed in the persistent calyx, 3 mm. long, 2 mm. broad below, conical; seeds ·75 mm. long, ·5 mm. broad, ellipsoid; testa reddish-brown.

Very closely allied to *W. montana*, DC., from which it is easily distinguished by the smaller and differently shaped leaves which are narrowed at the base into a flat petiole. I can find no material difference in the floral structure. At first I thought this plant should be regarded as a form of *W. montana*, DC., but as Madame Dieterlen's specimens are so utterly different from, and can so easily be distinguished from this species, I decided to keep them specifically distinct.

### ***W. pinifolia*, N. E. Br.**

Natal, on damp rocks, 5–6000 ft., February, *Evans*, 348.

DISTRIBUTION: Endemic.

*W. Galpinii*, Phillips, sp. nov. *Planta* pusilla, 7–10 cm. alta. *Rami* minute pubescentes. *Folia* 3–1·1 cm. longa, ·5–2 mm. lata, linearia vel spatulato-linearia, apice obtusa, basi angustata, glabra. *Flores* solitarii, terminales vel axillares. *Pedicellus* circiter 2 mm. longus, glaber vel minute pubescens. *Tubus calycis* 1·5 mm. longus, glaber; lobi 3 mm. longi, ovato-lineares, apice obtusi, glabri. *Tubus corollae* 3 mm. longus, glaber; lobi 2·5 mm. longi, 1·75 mm. lati, acuminati. *Filamenta* 1·5 mm. longa, oblonga, basi ·5 mm. lata minute ciliataque, supra linearia; antherae 1·25 mm. longae, oblongo-lineares. *Ovarium* triloculare; stylus 2 mm. longus, teres, glaber; lobi 3.

Wittebergen, Ben McDhui, Barkly East Division, 9300–9500 ft., March, *Galpin*, 6761.

A dwarf plant 7–10 cm. high. *Branches* terete, minutely pubescent.

*Leaves* .3–1.1 cm. long, .5–2 mm. broad, linear or spatulate-linear, obtuse, narrowed at the base, glabrous. *Flowers* solitary, terminal or axillary. *Pedicels* about 2 mm. long, glabrous or minutely pubescent. *Calyx-tube* 1.5 mm. long, glabrous; lobes 3 mm. long, ovate-linear, obtuse, glabrous. *Corolla* mauve; tube 3 mm. long, glabrous; lobes 2.5 mm. long, 1.75 mm. broad, bluntly acuminate. *Filaments* 1.5 mm. long, oblong, and .5 mm. broad in the lower half and very finely ciliate, linear above; anthers 1.25 mm. long, oblong-linear. *Ovary* 3-celled; style 2 mm. long, terete, glabrous; stigmas 3.

Near *W. depressa*, W. & E., but differs in having flattened non-ciliated leaves.

**W. sp.**

Harrismith, *Krook*, 2764!

## ERICACEAE.

### ERICA, *Linn.*

#### **E. cerinthoides**, Linn.

Cliffs and mountain slopes. 2–3 ft. high, flowers bright red. Autumn. *A. Dieterlen*, 123!; Basutoland, without precise locality, *Cooper*, 758.

**DISTRIBUTION:** Worcester. Malmesbury. Cape. Caledon. Riversdale. Knysna. Uitenhage. Port Elizabeth. Albany. Tembuland. Pondoland. Natal. Transvaal (Waterfall Creek, MacMac, Lydenburg).

**SESUTO:** *Momōnyane* or *Semōmōnyane*. Derived from the verb “ho momōnya”—to suck up. The flowers are visited by birds for the nectar. The native children suck the flowers for the sweet nectar.

#### **E. alopecurus**, Harv.

Mountain slopes and plateau. 9–20 in. high, flowers mauve-carmine. Autumn. *A. Dieterlen*, 274!; Basutoland, without precise locality, *Cooper*, 756; Luhana Pass, Drakensberg Range, *Galpin*, 2321; Natal, near Van Reenen, *Schlechter*, 6992.

**DISTRIBUTION:** Cathcart. King William's Town. Stutterheim. Somerset East. East Griqualand. Transvaal (Gemsbok Spruit, Komati).

**SESUTO:** *Chesa-litelu*. Burn the beard. Used as fuel. The natives say a fire made with this plant produces many sparks which fly up and burn the beards of the men sitting round it.

#### **E. algida**, Bolus.

Slopes of high mountains at Malavaneng, Leribe District. 2½–4 ft. high, flowers pink. Summer. *A. Dieterlen*, 862!; Qoqolosi Peak,

*Phillips*, 990!; Basutoland, Machacha, *Bryce*: on the higher slopes of the Mont-aux-Sources, *Flanagan*, 2030, *Thode*, 33; Nelson's Kop, *Cooper*, 854; near the source of the Umtjesi River, *Thode*, 63.

DISTRIBUTION: East Griqualand.

SESUTO: *Lekhapu le lenyenyane*. The small "Lekhapu." Used for fuel.

**E. Flanagani**, Bolus.

On the landward slopes of the Mont-aux-Sources, above the Eland's River Valley, 8000 ft., *Flanagan*, 2031.

DISTRIBUTION: Endemic.

**E. trichoclada**, G. & B.

Natal, Polela, *Evans*, 673.

DISTRIBUTION: Natal (Liddesdale).

**E. Tysoni**, Bolus.

Natal, on the Drakensberg Range, at Polela, *Evans*, 673.

DISTRIBUTION: East Griqualand.

**E. drakensbergensis**, G. & B.

Natal, Van Reenen, 5-6000 ft., February, *Wood*, 6066.

DISTRIBUTION: East Griqualand. Transvaal (eastern portion).

**E. sitiens**, Klotz.

Natal, Drakensberg, *Wood*, 9732.

DISTRIBUTION: Stellenbosch. Caledon.

**E. Schlechteri**, Bolus.

Mont-aux-Sources, 6000 ft., Bolus.

DISTRIBUTION: Queenstown. Natal.

**E. frigida**, Bolus.

Mont-aux-Sources, 9500 ft., *Flanagan*, 2029, *Thode*, 3265, *Bolus*: Natal, Amawahqua Mtn., *Evans*, 675, *Wood*, 4580.

DISTRIBUTION: East Griqualand.

**E. Woodii**, Bolus.

Oliver's Hoek and Mont-aux-Sources, *Thode*, 60, 61; Natal, Polela, *Evans*, 674; Summit Maclear Pile, 5200 ft., March, *Galpin*, 6763.

DISTRIBUTION: Clanwilliam. Stutterheim. Graaff Reinet. Orange Free State (without locality). Transvaal (Barberton, Houtbosch).

**E. maesta**, Bolus.

Ravine at Leribe, December, *A. Dieterlen*, 15!; *Phillips*, 989!; Basutoland, without precise locality, *Cooper*, 759, 760.

DISTRIBUTION: Humansdorp. Bedford. Queenstown. Graaff Reinet.



**E. leucopelta**, Tausch.

Mountain slopes and ravine. Flowers cream and crimson, November,  
A. Dieterlen, 386! 720!

DISTRIBUTION : Stockenstrom.

**E. Solandra**, Andr.

Natal, Van Reenen's Pass, 7000 ft., *Schlechter*, 6938.

DISTRIBUTION : George.

**E. Cooperi**, Bolus, var. **Missionis**, Bolus.

Eastern slopes of Drakensberg, between Pot River Berg and Tsitsa  
Footpath, 6000-7800 ft., March, *Galpin*, 6765.

DISTRIBUTION : Tembuland. East Griqualand.

**E. Caffrorum**, Bolus, var. **luxurians**, Bolus.

Natal, foot of the Drakensberg Range, *Wood*, 3519; Mawahqua  
Peak, Polela, *Wood*, 4281.

DISTRIBUTION : Endemic.

var. **aristulata**, Bolus.

Drakensberg Range, A. Bolus in *Herb. Guthrie*, 4976.

DISTRIBUTION : Endemic.

**E. Thodei**, G. & B.

Rocky places on the summit of the Mont-aux-Sources, near the  
sources of the Tugela River, 9-10000 ft., *Thode*, 64; Doodman's Krans  
Mtn., 8650-9000 ft., March, *Galpin*, 6766.

DISTRIBUTION : Endemic.

**E. lasiocarpa**, G. & B.

Natal, rocky places near Van Reenen, 7000 ft., *Schlechter*, 6941.

DISTRIBUTION : Endemic.

PHILIPPIA, Kl.

**P. Evansii**, N. E. Br.

Natal, near Ulundi, 5-6000 ft., *Evans*, 62.

DISTRIBUTION : Endemic.

PRIMULACEAE.

LYSIMACHIA, Linn.

**L. Woodii**, Schltr.

Natal, Van Reenen's Pass, in a damp valley, 5-6000 ft., *Wood*,  
4522.

DISTRIBUTION : Endemic.

## MYRSINEAE.

MYRSINE, *Linn.***M. africana**, *Linn.*

Mountain slopes and ravines. 4–8 ft. high, flowers white. Spring. *A. Dieterlen*, 64a! 64b!; common undershrub in ravines, *Phillips*, 578! 784!; Basutoland, without precise locality, *Cooper*, 738! 2697; Natal, near Van Reenen, *Schlechter*, 6999.

DISTRIBUTION: Van Rhynsdorp. Clanwilliam. Cape. Caledon. Swellendam. Knysna. Uitenhage. Albany. Queenstown. Cathcart. Somerset East. Aberdeen. Middelburg. East Griqualand. Transvaal (Shiluvane, near Blauw Bank).

SESUTO: *Thakhisa*. A peg. *Morokoana-phelu*. He who sews the rams. Pegs are made from the wood to pin skins to the ground when drying. Also given to rams to prevent them covering the ewes before the proper time.

## EBENACEAE.

ROYENA, *Linn.***R. lucida**, *Linn.*

Basutoland, without precise locality, *Cooper*, 2157; Orange Free State, Drakensberg, *Cooper*, 1062!; in Pot River Berg Forest, 5500 ft., March, *Galpin*, 6769; Natal, Van Reenen's Pass, *Rehmann*, 7242, 5–6000 ft., December, flowers yellow tinged with pink, *Wood*, 9728!; Drakensberg, at Mount Prospect, *Rehmann*, 6998!

DISTRIBUTION: Namaqualand Minor. Malmesbury. Tulbagh. Cape. Caledon. Swellendam. Knysna. Uitenhage. Albany. Fort Beaufort. Stockenstroom. Cathcart. Somerset East. East Griqualand. Orange Free State (without locality).

**R. villosa**, *Linn.*

Basutoland, without precise locality, *Cooper*, 2687!

DISTRIBUTION: Uitenhage. Albany. Bathurst. Natal. Orange Free State (without locality).

**R. hirsuta**, *Linn.*

Mountain slopes. 5–8 ft. high, flowers crimson. Spring. *A. Dieterlen*, 144a! 144b!; Bester's Vlei, near Witzie's Hoek, *Miss Jacobsz in Herb. Bolus*, 8118!; Natal, near Van Reenen, 5500 ft., *Schlechter*, 6956, *Wood*, 5658.

DISTRIBUTION: Namaqualand Minor. Clanwilliam. Malmesbury. Cape. Caledon. Swellendam. Uniondale. Humansdorp. Albany.

Queenstown: Calvinia. Worcester. Beaufort West. Somerset East. Graaff Reinet. Aberdeen. Griqualand West. Orange Free State (Bloemfontein). Bechuanaland. Transvaal (Waterval River, near Johannesburg).

SESUTO: *Ntlo ea makhoaba*. The house of the rook. *Senōkōnōkō* and *Maehiehe*. Meanings unknown. Before the introduction of matches into Basutoland, a stick prepared from this plant was used to kindle a fire by means of friction. Used as fuel.

**R. sp.** (deflorate).

Mountain slopes, Leribe. *A. Dieterlen*, 715!

SESUTO: *Mohloare-thatjane*. The hard "Mohloare" (Olive tree). Walking sticks are made from the hard wood.

### EUCLEA, *Murr.*

**E. coriacea**, A. DC.

Mountain slopes and ravines. A tree, flowers cream. Spring. *A. Dieterlen*, 195!

DISTRIBUTION: Queenstown. Graaff Reinet.

SESUTO: *Balikokotana*. The father of the round objects (so named on account of the round fruits). *Pholo-li-kokoto*. The oxen (fruits) are round. *Phele-li-kokoto* and *Thele-li-kokoto*. The fruits which are round. Used in the form of a decoction together with **E. lanceolata** or alone to wash the divining bones in order to give them accuracy. Also employed as a purgative.

**E. lanceolata**, E. Mey.

Mountain slopes. 7–10 ft. high, flowers greenish. Spring. *A. Dieterlen*, 63!; Basutoland, without precise locality, *Cooper*, 3464, 3481; in Pot River Berg Forest, 5500 ft., March, *Galpin*, 6770.

DISTRIBUTION: Swellendam. Knysna. George. Uniondale. Uitenhage. Port Elizabeth. Albany. Queenstown. Calvinia. Somerset East. Beaufort West. King William's Town. Transkei. Natal. Transvaal (Magaliesberg, near Middleburg; Pretoria, near Johannesburg).

SESUTO: *Mohlakōlo*. He who wipes. *Motsetlèla*. Meaning unknown. Used as fuel. See also note under *E. coriacea*.

**E. multiflora**, Hiern.

Basutoland (doubtful), *Cooper*, 3488.

DISTRIBUTION: Clanwilliam. Tulbagh. Humansdorp. Uitenhage. Albany. Bathurst. Natal.

**E. natalensis**, A. DC.

Natal, up to the Drakensberg, July, *Wood*, 958.

DISTRIBUTION: Transvaal (Barberton).

**E. daphnoides**, Hiern.

Natal, Upper Tugela River, *Gerrard*, 1506, 1606.

DISTRIBUTION: Swellendam. Humansdorp. Uitenhage. Port Elizabeth.

## OLEACEAE.

JASMINUM, *Linn.***J. angulare**, Vahl.

Natal, Oliver's Hoek Pass, 4-5000 ft., January, *Wood*, 3515.

DISTRIBUTION: Uitenhage. Port Elizabeth. Albany. Somerset East. East Griqualand. Orange Free State (without locality). Transvaal (Komati Poort).

MENODORA, *Humb. & Bonpl.***M. africana**, Hook.

Natal, near the Tugela River, 4-5000 ft., January, *Wood*, 3550; Bushman's River, *Gerrard*, 631.

DISTRIBUTION: Zululand. Griqualand West. Bechuanaland. Transvaal (near Pretoria, Derde Poort, near Irene, Magaliesberg, near Lydenburg, near Barberton, near Potchefstroom).

OLEA, *Linn.***O. verrucosa**, Link.

Mountain slopes and ravines. A tree, flowers cream. Summer. *A. Dieterlen*, 313!

DISTRIBUTION: Cape. Paarl. Uitenhage. East London. Albany. Queenstown. Cathcart. Somerset East. Graaff Reinet. Komgha. Natal. Transvaal (Pretoria, Magaliesberg).

SESUTO: *Mohloare*. The olive tree. A preparation used for headache is made from it. Strong walking-sticks and knobkerries are made from the wood. A vegetative specimen (*A. Dieterlen*, 715) I take to be this species.

## APOCYNACEAE.

CARISSA, *Linn.***C. Arduina**, Lam.

Natal, Polela, 4-5000 ft., *Fernando*; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8105!

DISTRIBUTION : Swellendam. Bredasdorp. Mossel Bay. George. Uitenhage. Albany. Bathurst. Somerset East. Pondoland. Natal. Transvaal (Klerksdorp, Houtbosch).

## ASCLEPIADACEAE.

### RAPHIONACME, Harv.

#### **R. divaricata**, Harv.

Veld and mountain slopes. 3-12 in. high, flowers violet, early spring. *A. Dieterlen*, 158!; Harrismith, *Sankey*, 19.

DISTRIBUTION : Alexandria. Albany. Bathurst. Queenstown. Komgha. Transkei. Tembuland. East Griqualand. Natal.

SESUTO : *Kherenchane*. Meaning unknown. A medicine for internal tumours is prepared from the plant. Recently the plant has been used by the natives for making a very intoxicating beverage called "ghali" by mixing it with treacle or sugar, kaffir-corn, and water.

### PARAPODIUM, *E. Mey.*

#### **P. costatum**, *E. Mey.*

Veld. 12-25 in. high, flowers mauve. Summer. *A. Dieterlen*, 189!; on the Wittebergen, *Drège*.

DISTRIBUTION : Orange Free State (Rhenoster River). Transvaal (Vereeniging, Lydenburg, Magaliesberg, Modderfontein, Johannesburg, Pietersburg).

SESUTO : *Sehamela*. He who milks for the goat. Eaten as a vegetable. Said to be much liked by goats.

#### **P. simile**, *N. E. Br.*

Bester's Vlei, near Witzie's Hoek, *Bolus*, 6348!

DISTRIBUTION : Transvaal (near Rustenburg).

### XYSMALOBIUM, *R. Br.*

#### **X. stockenstromense**, Scott-Elliot.

Grassy slopes of the Mont-aux-Sources, 7800 ft., *Thode*, 36!

DISTRIBUTION : Stockenstroom. Stutterheim. East Griqualand. Natal. Transvaal (Belfast, Carolina, Donker Hoek).

#### **X. undulatum**, *R. Br.*

Veld and mountain slopes. 20-42 in. high, flowers pale cream and green. Summer. *A. Dieterlen*, 31!

DISTRIBUTION : Paarl. Cape. Swellendam. Alexandria. Albany. Queenstown. Richmond. Victoria West. Somerset East. Orange



Free State (near Seven Fountains). Transvaal (Springbok Flats, Pretoria, Modderfontein, Johannesburg, Standerton).

SESUTO: *Leshokhoa*. Meaning unknown. The young leaves are eaten as a spinach.

**X. parviflorum**, Harv.

Mountain slopes. 7-20 in. high, flowers greyish violet. Summer. *A. Dieterlen*, 473!; Basutoland, without locality, *Cooper*, 934; Bester's Vlei, near Witzie's Hoek, 6300 ft., *Bolus*, 8112; Harrismith, *Sankey*, 134; Natal, Weenen County, 3-6000 ft., *Sutherland*, *Wood*, 4370; near Van Reenen, *Wood*, 6633.

DISTRIBUTION: Transkei. East Griqualand. Transvaal (between Waterval River and Zuikerbosch Rand).

SESUTO: *Leoto la Khoko*. The foot of a fowl. *Ntsine*. Meaning unknown. A medicine for colic is prepared from it.

**X. Woodii**, N. E. Br.

Natal, Van Reenen, 5-6000 ft., *Wood*, 10830.

DISTRIBUTION: Endemic.

PERIGLOSSUM, *Decne.*

**P. angustifolium**, *Decne.*

Damp spots on veld. 8-22 in. high, flowers dark yellow. Summer. *A. Dieterlen*, 491a!

DISTRIBUTION: Komgha. Transkei. Tembuland. East Griqualand. Natal. Transvaal (Magaliesberg, Johannesburg, Modderfontein).

SESUTO: *Schoètè mohlaka*. The carrot of the marsh. *Schoètè Ntsiuli*. Meaning unknown. The roots of this plant and of all species of *Schizoglossum* are eaten, especially by children (*Schoètè* = carrot).

SCHIZOGLOSSUM, *E. Mey.*

**S. atropurpureum**, *E. Mey.*

Shady spots on mountain slopes. 30-50 in. high, flowers very dark brown. Summer. *A. Dieterlen*, 493!; Bester's Vlei, near Witzie's Hoek, *Bolus*, 8111!; Harrismith, *Sankey*, 192; Natal, slopes of the Drakensberg Range at Oliver's Hoek, 5-6000 ft., January, *Wood*, 3471; on the Wittebergen, 5-6000 ft., *Drège*.

DISTRIBUTION: Endemic.

SESUTO: *Schoètè-moru*. The wood-carrot (because the plant grows on the mountain slopes, near shrubs). The roots are eaten raw.

**S. elingue**, N. E. Br.

Natal, slopes of the Drakensberg Range, 6-7000 ft., *Evans*, 358.

DISTRIBUTION : Endemic.

**S. flavum**, Schltr., var. **lineare**, N. E. Br.

Natal, Drakensberg, *A. Bolus in Herb. Guthrie*, 4878!

DISTRIBUTION : Endemic.

**S. stenoglossum**, Schltr.

Basutoland, without precise locality, *Cooper*, 2722; Harrismith, *Sankey*, 191; Natal, Van Reenen, 5500 ft., October-December, *Wood*, 4561, 4778, 5009; highest grassy slopes of the Caledon Range (spur of Drakensberg), c. 8100 ft., January, flowers dark purple, *Thode*, 38!

DISTRIBUTION : Transkei. Tembuland. East Griqualand. Transvaal (no locality).

**S. pachyglossum**, Schltr.

Basutoland, without precise locality, *Cooper*, 3147; on a hill near Harrismith, 5-6000 ft., *Wood*, 5383, *Sankey*, 178; Bester's Vlei, near Witzie's Hoek, 6000 ft., *Bolus*, 8110! *Flanagan*, 1881.

DISTRIBUTION : King William's Town. East Griqualand. Natal.

**S. linifolium**, Schltr.

Veld and plateau. 12-25 in. high, flowers yellow. Summer. *A. Dieterlen*, 26!; Basutoland, without precise locality, *Cooper*, 2727.

DISTRIBUTION : Riversdale. Humansdorp. Uitenhage. Albany. Stockenström. Queenstown. Cathcart. Somerset East. Cradock. Aliwal North. Albert. King William's Town. Komgha. Transkei. Tembuland. East Griqualand.

SESUTO : *Schoète Ntlhokoe*. Meaning unknown. The root is eaten raw.

**S. pumilum**, Schltr.

Harrismith, *Sankey*, 180.

DISTRIBUTION : Orange Free State (Bethlehem). Transvaal (between the Waterval River and Zuikerbosch Rand).

**S. robustum**, Schltr.

Bester's Vlei, near Harrismith, 5500 ft., *Bolus*, 8108!; near Harrismith, *Sankey*, 177.

DISTRIBUTION : Pondoland. Natal. Transvaal (Donker Hoek).

**S. pulchellum**, Schltr.

Plateau. 6-15 in. high, flowers brown, cream and crimson. Summer. *A. Dieterlen*, 801!; Basutoland, without precise locality, *Cooper*, 2729;

Bester's Vlei, near Witzie's Hoek, *Flanagan in Herb. Bolus*, 8109!; Harrismith, *Sankey*, 182; Van Reenen's Pass, 5500 ft., *Wood*, 5143! 4256.

DISTRIBUTION: Transvaal (Barberton, near Botsàbelo, near Belfast, near Roodepoort).

SESUTO: *Sehoètè Mpulutsoana*. The greyish carrot. The root is eaten raw.

**S. biflorum**, Schltr.

Veld, mountain slopes and plateau. 8-25 in. high, flowers violet. Summer. *A. Dieterlen*, 370!

DISTRIBUTION: Cathcart. Queenstown. Aliwal North. Transkei. Natal. Transvaal (Klein Oliphant's River, near Johannesburg, Magaliesberg, Modderfontein).

**S. araneiferum**, Schltr.

Veld. 6 in. high, flowers whitish. Summer. *A. Dieterlen*, 853b!; Bester's Vlei, near Witzie's Hoek, *Bolus*, 8107!

DISTRIBUTION: Natal (Newcastle). Transvaal (near Lydenburg).

SESUTO: *Sehoètè Nthokoe*. The slender carrot. The root is eaten raw.

**S. lamellatum**, Schltr.

Veld and mountain slopes. 7-16 in. high, flowers whitish. Spring-Summer. *A. Dieterlen*, 853a!

DISTRIBUTION: Cape. Wodehouse. Natal. Transvaal (Magaliesberg, near Johannesburg, Waterval River, Rustenburg, Pretoria, Pilgrim's Rest).

SESUTO: *Sehoètè-moro*. The juicy carrot. The root is eaten raw.

**S. interruptum**, Schltr.

Veld, mountain slopes and plateau. 20-48 in. high, flowers greyish-mauve. Summer. *A. Dieterlen*, 490! Wittebergen, 5000 ft. *Drège*, 3428.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Ermelo).

SESUTO: *Sehoètè Phofu*. The carrot of the eland. *Sehoètè Legaia*. The bamboo carrot. *Moramaphofu*. Meaning unknown. The root is eaten raw.

ASCLEPIAS, *Linn.*

**A. cucullata**, Schltr.

Harrismith, *Sankey*, 185; Natal, Van Reenen, 5-6000 ft., November-December, flowers pink and white, *Wood*, 4820, 5384! 5667!

DISTRIBUTION: Transkei. Natal. Swaziland. Transvaal (Barberton, Zoutpansberg).

**A. stellifera**, Schltr.

Veld and mountain slopes. 5–12 in. high, flowers mauve and pinkish. Summer. *A. Dieterlen*, 261!; Basutoland, without precise locality, *Cooper*, 2721, 2735; Natal, Klip River, *Sutherland*.

DISTRIBUTION: Queenstown. Aliwal North. Transkei. Griqualand West. Orange Free State (Bethlehem). Transvaal (near Johannesburg, Barberton, Zuikerbosch Rand, Heidelberg, Springbok Flats, Modderfontein).

SESUTO: *Moholantja*. He who attracts dogs.

**A. multicaulis**, Schltr.

Veld and mountain slopes. A creeping plant, 4–9 in. long, flowers violet. Summer. *A. Dieterlen*, 116!; Basutoland, without precise locality, *Cooper*, 935; Harrismith, *Sankey*, 183; Wittebergen, *Drège*, Ladybrand, c. 6000 ft., *Bertha Rogers in Herb. Bolus*, 13430!

DISTRIBUTION: Queenstown. Transkei. Natal. Orange Free State (Bethlehem). Transvaal (Witkleifontein).

SESUTO: *Lenkiling*. Meaning unknown. *Lekhoaphèla*. He who draws his legs together when sitting on the ground (an allusion to the habit of the plant, whose branches lie close to one another on the ground). The plant is eaten freely, either cooked or raw.

**A. brevicuspis**, Schltr.

Basutoland, without precise locality, *Cooper*, 2721 bis, 2724.

DISTRIBUTION: Albany. King William's Town. Pondoland. Natal. Zululand. Transvaal (near Piet Retief).

**A. gibba**, Schltr.

Wittebergen, *Drège*, 4973; Bester's Vlei, near Witzie's Hoek, December, *Bolus*, 8113!

DISTRIBUTION: Albany. Bedford. Stockenstroom. Queenstown. Somerset East. Molteno. Komgha. Transkei. Tembuland. Pondoland. East Griqualand. Natal. Orange Free State (Vredefort). Transvaal (near Pretoria, Ermelo, Standerton, Modderfontein).

var. *media*, N. E. Br.

Bester's Vlei, near Witzie's Hoek, *Bolus*, 8113; Caledon River, *Burke*.

DISTRIBUTION: Zululand. Swaziland. Transvaal (Standerton, Magaliesberg, Rustenberg, Nylstroom).

**A. eminens**, Schltr.

Veld. 8-14 in. high, flowers green, pink, and white. Summer.

*A. Dieterlen*, 365!

DISTRIBUTION: Orange Free State (Sevenfontein). Transvaal (Lydenburg, Pretoria, Ermelo, etc.). Natal. Zululand. Swaziland.

SESUTO: *Montsuku*. *Motsōkō*. *Montsōkō*. Meanings unknown. The whole plant is eaten raw.

**A. aurea**, Schltr.

Veld, mountain slopes. 13-22 in. high, flowers yellowish. Summer.

*A. Dieterlen*, 655!

DISTRIBUTION: Cape. Natal. Transvaal (Barberton, Pilgrim's Rest, near Johannesburg, Modderfontein, Rustenburg, Zoutpansberg, Magaliesberg, Malelane, Matebe, Mooi River, Carolina).

SESUTO: *Mohlatsisa*. He who causes vomiting. Used as an emetic.

var. **vittata**, N. E. Br.

Basutoland, without precise locality, *Cooper*, 932.

DISTRIBUTION: Natal. Swaziland. Orange Free State (Bethlehem). Transvaal (Barberton).

**A. schizoglossoides**, Schltr.

Natal, Van Reenen. 5-6000 ft., November, *Wood*, 6576.

DISTRIBUTION: Albany. Fort Beaufort. Stutterheim.

**A. decipiens**, N. E. Br.

Mountain slopes. 20-40 in. high, flowers dark yellow. Summer.

*A. Dieterlen*, 631!; among rocks under cliffs and mountain slopes, occasional, *Phillips*, 812! 836!

DISTRIBUTION: Natal. Transvaal (near Irene, Wonderboompoort, Johannesburg, Pretoria).

SESUTO: *Moethimōlo oa thaba*. He of the mountain who causes sneezing. *Molimōla oa thaba*. He of the mountain who reveals. *Lebeyana la thaba*. The small cream of the mountain. Used as a snuff and as a medicine for sore breasts.

**A. fruticosa**, Linn.

Veld and mountain slopes. 30-45 in. high, flowers pale yellow. Summer. *A. Dieterlen*, 84!; bush 2-4 ft., flowers cream, common. *Phillips*, 518!; Harrismith, *Sankey*, 241.

DISTRIBUTION: Cape. Oudtshoorn. Riversdale. George. Knysna, Queenstown. Graaff Reinet. Colesberg. King William's Town. Natal. Griqualand West. Orange Free State (Bethlehem, Vredefort, Parys) Transvaal (Pretoria, Lydenburg, Platsand, Irene, Fourteen



Streams, Crocodile River, Johannesburg, Modderfontein, Pilgrim's Rest, Hebron).

SESUTO: *Moethimōlo*. He who causes sneezing. *Molimōlo*. He who reveals. *Lebeyana*. Small cream. Used as a cure for a cold in the head. The silky hairs of the seeds are used to make pillows.

**A. humilis**, Schltr.

Basutoland, Machacha Mountain, *Bryce*; Mont-aux-Sources, 8000 ft., *Flanagan in Herb. Bolus*, 8117; Caledon Range, *Thode*, 39; Wittebergen, 6-7000 ft., *Drège*, 3240.

DISTRIBUTION: Endemic.

**A. adscendens**, Schltr.

Basutoland, without precise locality, *Cooper*, 2720.

DISTRIBUTION: East Griqualand. Swaziland. Transvaal (Barberton, Rustenberg, Heidelberg, Pretoria, Springbok Flats, Irene, Matebas Valley, Modderfontein).

PACHYCARPUS, *E. Mey.*

**P. rigidus**, *E. Mey.*

Mountain slopes. Flowers yellowish-purple. Summer. Sebothvane, near Leribe, *A. Dieterlen*, 377a!; Matelas Peak, *Thode*, 34.

DISTRIBUTION: Tarkastad. Aliwal North. Orange Free State (near Bethlehem). Transvaal (Mooi River, Ermelo).

SESUTO: *Phōma-metsu*. He who cuts the arrows (or thorns). *Leshokoana*. The small "Leshokhoa." Used for curing colic pains (the natives compare the pains to arrows piercing the intestines). In spring the plant is used as a vegetable.

var. **tridens**, *E. Mey.*

At the foot of the Wittebergen, *Drège*, 6393.

DISTRIBUTION: Queenstown. Orange Free State (Bethlehem). Transvaal (Witkleifontein).

**P. macrochilus**, N. E. Br.

Harrismith, *Sankey*, 181; Bester's Vlei, near Witzie's Hoek, 6200 ft., *Bolus*, 8115; *Flanagan*, 2067; Mont-aux-Sources, 7800 ft., *Thode*, 35.

DISTRIBUTION: Orange Free State (Bethlehem).

**P. stenoglossus**, N. E. Br.

Wittebergen, 6-7000 ft., *Drège*, 3419

DISTRIBUTION: Endemic.

**P. dealbatus**, E. Mey.

Basutoland, without precise locality, *Cooper*, 931; Natal, near Hoffenthal, 4000 ft., December, *Wood*, 3473; bank of Tugela River, 4500 ft., January, *Wood*, 3475.

DISTRIBUTION: Swellendam. George. Humansdorp. Uitenhage. Port Elizabeth. Alexandria. Bathurst. Albany. Queenstown. Cradock. King William's Town. Komgha. Transkei. Tembuland. Pondoland. East Griqualand.

**P. campanulatus**, N. E. Br., var. **Sutherlandi**, N. E. Br.

Basutoland, without precise locality, *Cooper*, 936, 2731; Natal, Mhlabamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: King William's Town. Tembuland. East Griqualand. Transvaal (MacMac, Houtbosch, Barberton, Eland's River Mtn., Belfast, Valkfontein Beacon, Spitz Kop, Pilgrim's Rest).

CYNANCHUM, *Linn.***C. virens**, Dietr.

Mountain slopes. Climber, 3-6 ft. high, flowers white. Summer. *A. Dieterlen*, 457!

DISTRIBUTION: Queenstown. Aliwal North. Albert. Griqualand West. Orange Free State (no locality). Transvaal (near Pretoria, Irene).

SESUTO: *Molōlō*. Meaning unknown. In times of famine the roots were cooked and eaten.

SARCOSTEMMA, *R. Br.***S. viminale**, R. Br.

Hanging down from a cleft in mountain cliffs behind the Mission Station, 3-9 ft. long, flowers whitish. Summer. *A. Dieterlen*, 819!

DISTRIBUTION. Van Rhynsdorp. Mossel Bay. Knysna. Uitenhage. Bathurst. Albany. Queenstown. Prince Albert. Graaff Reinet. King William's Town. Komgha. Natal. Griqualand West. Transvaal (Komati Poort, Potgeiter's Rust).

SESUTO: *Namele ea lilomo*. The spreading one of the cliffs.

SISYRANTHUS, *E. Mey.***S. imberbis**, Harv.

Mountain slopes and river banks. 20-40 in. high, flowers mauve-grey. Summer. *A. Dieterlen*, 277!; Basutoland, without precise locality, *Cooper*, 2730.

DISTRIBUTION: Albany. Transkei. Natal. Orange Free State (no locality).

SESUTO: *Malla a ntebile*. Sorrows are facing one. Eaten by young men who are courting, in order to win the love of the girls and so avoid sorrow.

RIOCREUXIA, *Decne.*

**R. picta**, Schltr.

Mountain slopes, a climber on rocks. 3-6 ft. long, flowers pale yellow. Summer. Near the River Qalo at the Mission Station, *A. Dieterlen*, 711!

DISTRIBUTION: Swaziland. Transvaal (Barberton, Houtbosch, Ingome Range, between Pilgrim's Rest and Sabie).

SESUTO: *Morarana oa nōka*. The small creeper of the river.

**R. torulosa**, Decne., var. *tomentosa*, N. E. Br.

A climber among trees and rocks in ravines. 3-6 ft. high, yellow. Summer. *A. Dieterlen*, 616!; Basutoland, without precise locality, *Cooper*, 2719 partly; Harrismith, *Sankey*, 316; Van Reenen, 5-6000 ft., December, *Wood*, 4539.

DISTRIBUTION: Transkei.

SESUTO: *Morarana oa moru*. The small creeper of the wood.

CEROPEGIA, *Linn.*

**C. Meyeri**, Decne.

Natal, Oliver's Hoek Pass, 5000 ft., January, *Wood*, 3476.

DISTRIBUTION: Komgha. Transkei. Tembuland. Transvaal (Barberton, Elandspruit Mountains, Masetana Valley).

BRACHYSTELMA, *R. Br.*

**B. foetidum**, Schltr.

Veld and plateau. 3-10 in. high, flowers dark crimson, scented. Summer. *A. Dieterlen*, 364!; Basutoland, without precise locality, *Cooper*, 933; near Harrismith, *Sanderson*, 6, *Sankey*, 187, *Thode*; Bester's Vlei, near Witzie's Hoek, *Miss Jacobsz*.

DISTRIBUTION: Orange Free State (Vals River, Parys). Transvaal (Mooi River, near Elsburg, Potchefstroom, Houtbosch, Modderfontein).

SESUTO: *Seru*. Meaning unknown. Used as a medicine for children's colds. The roots are eaten by shepherd boys.

**B. commixtum**, N. E. Br.

Hills near Riet Valley, at foot of the Wittebergen. 5000 ft., *Drège*, 3440 partly.

DISTRIBUTION: Endemic.

**B. circinatum**, E. Mey.

Hills near Riet Valley, at the foot of the Wittebergen, 5000 ft., *Drège*, 3440 partly.

DISTRIBUTION: Transvaal (near Mooifontein).

ANISOTOME, *Fenzl.***A. pedunculata**, N. E. Br.

Banks of dongas. A creeping plant, flowers mauve. Summer. *A. Dieterlen*, 800!; Natal, Tiger-cave Valley, Drakensberg Range, 6-7000 ft., *Evans*, 379; Niginya, 5500 ft., *Wylie in Herb. Wood*, 10529.

DISTRIBUTION: Endemic.

SESUTO: *Morarana oa letlapa*. The small creeper of the flat stone.

STAPELIA, *Linn.***S. flavirostris**, N. E. Br.

Mountain slopes. 2-10 in. high, flowers dark crimson, emit a bad odour. Summer. *A. Dieterlen*, 298!; Leribe, *Buchanan*.

DISTRIBUTION: Namaqualand Minor. George or Oudtshoorn. Bedford. Queenstown. Somerset East. Beaufort West. Victoria West. Richmond. Middleburg. Steynsburg. Albert. Colesberg. Griqualand West.

SESUTO: *Bohatsu*. Numbness. For curing numbness, the limb is bathed with a hot infusion of the plant.

## LOGANIACEAE.

GOMPHOSTIGMA, *Turez.***G. scoparioides**, *Turez.*

Banks and beds of stream. 20-35 in. high, flowers white. Summer. *A. Dieterlen*, 538! Basutoland, without precise locality, *Cooper*, 2870; Natal, Mohlamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Uitenhage. Queenstown. Stockenström. Prince Albert. Somerset East. Graaff Reinet. Murraysburg. Richmond. Albert. Colesberg. Hope Town. Transkei. East Griqualand. Natal.

SESUTO : *Moëma-thata*. He who stands firmly. *Mosika-nokana*. He who goes along the little river. Used as an infusion to restore strength to a tired person.

### CHILIANTHUS, Burch.

#### *C. corrugatus*, Benth.

Mountain slopes. 5-10 ft. high, flowers cream. Spring. *Makokoane*, Leribe District, *A. Dieterlen*, 618!; Witteberg Range, 5-6000 ft., near streams, *Drège*, 3618; near Harrismith, *Sankey*, 243.

DISTRIBUTION : Natal.

SESUTO : *Lelora*. He dreams. Used as fuel and for making walking-sticks.

### BUDDLEIA, Linn.

#### *B. salvifolia*, Lam.

Mountain slopes and ravines. 4-8 ft. high, flowers cream or mauve. Spring. *A. Dieterlen*, 54!; frequent in ravines, *Phillips*, 579!; Natal, Cathkin Peak, 6850-9200 ft., September, *West in Herb. Musei Austro-Afric.*, 4576!; Basutoland, without precise locality, *Cooper*, 695.

DISTRIBUTION : Clanwilliam. Caledon. George. Knysna. Uitenhage. Bedford. Queenstown. Stockenström. Somerset East. Graaff Reinet. Beaufort West. Albert. Tembuland. Pondoland. Natal. Transvaal (Magaliesberg, near Barberton, MacMac, near Lydenburg, near Pretoria).

SESUTO : *Lelothoane*. The small dreamer. The natives avoid plucking the flowers as they say sore eyes are the result. Used as fuel.

### GENTIANACEAE.

#### SEBAEA, Soland.

#### *S. mirabilis*, Gilg.

Maclear District, between Tent Kop and Antelope Park, 5600 ft., March, *Galpin*, 6772.

DISTRIBUTION : Transkei. Tembuland. Natal. Orange Free State. Transvaal (near Lydenburg).

#### *S. filiformis*, Schinz.

Tsitsa Footpath, Drakensberg, 7600 ft., March, *Galpin*, 6773; Natal, Polela, *Wood*, 1884.

DISTRIBUTION : Komgha. Transkei. Transvaal (near Lydenburg, Zoutspansberg).



**S. exigua**, Schinz.

Veld and plateau. 4-10 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 600!; Barkly East Division, near Rhodes, 6150 ft., *Galpin*, 2333.

DISTRIBUTION: Albany. Colesberg. Aliwal North. Griqualand West. Orange Free State (near Seven Fountains, Bloemfontein, Parys). Transvaal (near Klippan, near Johannesburg, near Pietersburg).

SESUTO: *Moroeroe*. Something seen vaguely at a distance.

**S. pygmaea**, Schinz.

Orange Free State. Top of Moolman's Kopje, at Zaaihoek, in the Harrismith District, 6500 ft., *Thode*.

DISTRIBUTION: Transvaal (Houtboschberg).

**S. conspicua**, A. W. Hill.

In a marsh near Harrismith, 7000 ft., *Sankey*, 173!

DISTRIBUTION: Endemic.

**S. Drègi**, Schinz.

Witteberg Range, 6000 ft., *Drège*.

DISTRIBUTION: Riversdale. Knysna. Graaff Reinet.

**S. schinziana**, Gilg.

Natal, Bushman's River, on the Drakensberg Range, *Evans*, 54.

DISTRIBUTION: Transvaal (Devil's Knuckles).

**S. macrophylla**, Gilg.

Basutoland, without precise locality, *Cooper*, 713; Orange Free State, Witteberg Range, *Rehmann*, 3999.

DISTRIBUTION: King William's Town. East Griqualand. Transvaal (near Pilgrim's Rest).

**S. leiostyla**, Gilg.

Damp spots on mountain slopes, veldt and plateau. 2-15 in. high, flowers bright yellow. *A. Dieterlen*, 74! common on plateau and mountain slopes, *Phillips*, 560! 663! 714! 810! 890! near Harrismith, *Sankey*, 175.

DISTRIBUTION: Natal. Orange Free State (Bethlehem). Transvaal (near Standerton, near Pretoria, Houtboschberg, near Vereeniging, Ermelo).

SESUTO: *Marama a baroetsana*. The cheeks of young girls (on account of the bright colour of the flower).

**S. hymenosepala** Gilg., var. **grandiflora**, A. W. Hill.

Doodman's Krans Mtn., 8850 ft., March, *Galpin*, 6776.

DISTRIBUTION: Endemic.

**S. repens**, Schinz.

Damp spots on Qoqolosi mountain slopes. 1-4 in. high, flowers bright yellow. Autumn-Winter. A. *Dieterlen*, 725!; Natal, damp places on flat rocks by the Bushman's River, 6-7000 ft., *Evans*, 56; Doodman's Krans Mtn. and Ben McDhui, 8500-9400 ft., March, *Galpin*, 5777.

DISTRIBUTION: East Griqualand. Transvaal (Ermelo).

SESUTO: *Marama a baroetsana a monyenyane*. The small cheeks of young girls.

**S. Marlothii**, Gilg.

Summit of the Mont-aux-Sources, 9500-10000 ft., *Mann in Herb. Marloth*, 2886; *Bolus*, 12950, 10664 partly.

DISTRIBUTION: Endemic.

**S. procumbens**, A. W. Hill.

Summit of the Mont-aux-Sources, 9500 ft., *Flanagan*, 2079.

DISTRIBUTION: Endemic.

**S. thodeana**, Gilg.

Summit of the Mont-aux-Sources, 10,000 ft., *Mann in Herb. Marloth*, 2878, *Flanagan in Herb. Bolus*, 8216; Natal, near Emengweni, 6-7000 ft., *Thode*, 67; Giant's Castle, 8000 ft., *Guthrie in Herb. Bolus*, 4882; Ben McDhui, 9400 ft., March, *Galpin*, 6777.

DISTRIBUTION: Endemic.

**S. spathulata**, Steud.

Basutoland, damp shady banks of the Buffalo River Waterfall, 8100 ft., March, *Galpin*, 6778; summit of the Mont-aux-Sources, 9500 ft., *Flanagan*, 2080; Natal, Giant's Castle, 6000 ft., *Guthrie in Herb. Bolus*, 4881; Wittebergen, 7500 ft., *Drège*.

DISTRIBUTION: Endemic.

**S. Thomasii**, Schinz.

Mont-aux-Sources, 6500-10,000 ft., *Flanagan in Herb. Bolus*, 8215, *Bolus*, 10664 partly; Natal, Tabamhlope, 6000 ft., *Wylie in Herb. Wood*, 10639; Giant's Castle, *Wylie in Herb. Wood*, 10639, *Guthrie in Herb. Bolus*, 4882 partly.

DISTRIBUTION: Fort Beaufort.

## EXOCHAENIUM, Griseb.

**E. grande**, Griseb.

Veld and mountain slopes. 3-9 in. high, flowers yellow. Autumn. *A. Dieterlen*, 262!; plateau and slopes, flowers pale yellow, uncommon, *Phillips*, 553! 652! 888!; without precise locality, *Bowker*!; Thaba Unchu, *Burke*, 205; near Harrismith, 5500 ft., *Sankey*, 176; Caledon River, *Mrs. Barber*, 20.

DISTRIBUTION: Komgha. Transkei. Tembuland. Natal. Orange Free State (between Rhenoster River and Vaal River). Transvaal (various localities).

SESUTO: *Liphalana*. Small trumpets. This refers to the shape of the corolla.

## CHIRONIA, Linn.

**C. palustris**, Burch.

Damp spots on mountain slopes. Flowers pale pink. Summer. Thaba Phatsoa, Leribe District, *A. Dieterlen*, 847!; near Harrismith, *Wood*, 4763.

DISTRIBUTION: Queenstown. Wodehouse. Transkei. East Griqualand. Natal. Griqualand West. Orange Free State (Sanddrift Spruit, Bethlehem). Bechuanaland. Transvaal (Standerton, near Wilge River).

SESUTO: *Lepshetlane*. Meaning unknown. See note under *C. Krebsii*.

**C. Krebsii**, Griseb.

Damp spots on mountain slopes. Flowers pink. Summer. Thaba Phatsoa, Leribe District, *A. Dieterlen*, 717!; near Harrismith, *Sankey*, 174.

DISTRIBUTION: Uitenhage. Bedford. Stockenstroom. Somerset East. Queenstown. East Griqualand. Natal. Swaziland. Transvaal (near Barberton, near Berg Spruit, Athol, Spitz Kop).

SESUTO: *Lepshetlane la liliba*. The "Lepshetlane" of the fountains. *Tjatane*. Derived from the verb "ho tjata"—to have diarrhoea (in children). Used for colic and diarrhoea in children and for relieving uneasiness in pregnant women.

## FAROA, Welw.

**F. salutaris**, Welw.

Basutoland, Machacha Mtn. *Bryce*.

DISTRIBUTION: Endemic.

SWERTIA, *Linn.*

**S. stellarioides**, Ficalho.

Mountain slopes. 10–18 in. high, flowers white. Summer. *A. Dieterlen*, 782!; without locality, *Bowker*!; marshes near Harrismith, 7000 ft., *Sankey*, 68; Natal, damp places near Van Reenen, 7500 ft., *Schlechter*, 6991.

DISTRIBUTION: Transvaal (Donkershoek, Houtbosch, near Lydenburg, Lomatie Valley).

SESUTO: *Se-nkha-koena*. It has the odour of “Koena” (“Koena” means both crocodile and mint; it is not clear to which the name refers).

BORAGINEAE.

EHRETIA, *Linn.*

**E. hottentotica**, Burch.

North slopes of Leribe Mountain. A shrub, flowers lilac. *A. Dieterlen*, 867!

DISTRIBUTION: Uitenhage. Albany. Queenstown. Willowmore. Somerset East. Carnarvon. Graaff Reinet. King William’s Town, Natal. Griqualand West. Bechuanaland. Transvaal (Pretoria. Barberton, Lydenburg, Waterval River).

SESUTO: *Morobo*. Derived from the verb “ho roba”—to break (the hunted animals). Hunters anoint themselves with a decoction of this and other plants when hunting; if they shake their shields the hunted animal will fall to the ground, its strength being broken.

TYSONIA, *Bolus*.

**T. africana**, Bolus.

Natal, foot of the Drakensbergen, 5000 ft., January, *Wood*, 3557.

DISTRIBUTION: East Griqualand.

CYNOGLOSSUM, *Linn.*

**C. enerve**, Turez.

Veld and mountain slopes. 8–35 in. high, flowers dark crimson and violet. Summer. *A. Dieterlen*, 375!; a subherbaceous plant, 1–2 ft. high, not common, *Phillips*, 542!; Natal, Polela, 5–6000 ft., April, *Wood*, 4577.

DISTRIBUTION: Cape. Riversdale. Uitenhage. Albany. Bathurst. Cathcart. Somerset East. Tembuland. Pondoland. Natal. Orange Free State (no locality). Transvaal (Aapie’s River, Johannesburg).

SESUTO: *Bōhōmenyana*. Derived from the verb “ho bohōme”—to stick to. Used as a medicine for colic in children.

**C. micranthum**, Desf.

Veld and dongas. 6-30 in. high, flowers blue. Summer. *A. Dieterlen*, 70!; slopes of plateau, occasional, *Phillips*, 514! 540! 897!; Basutoland, without precise locality, *Cooper*, 749; Mont-aux-Sources, 8000 ft., April, *Dyke in Herb. Marloth*, 5436!, in *Herb. Musei Austro-Afric.*, 5513!

DISTRIBUTION: Uitenhage. Stutterheim. Somerset East. Transkei. Tembuland. Natal. Orange Free State (no locality). Transvaal (near Blauw Bank, Pretoria, MacMac, Lydenburg, Houtbosch).

SESUTO: *Motlepèrè*. Something wet. *Bohōmenyana*. See *C. enerve*, also note.

## ECHINOSPERMUM, Sw.

**E. Lappula**, Lehm.

Veld, dongas, and cultivated lands. 8-20 in. high, flowers pale blue. Summer. *A. Dieterlen*, 330!

DISTRIBUTION: Swellendam. Uitenhage. Albany. Queenstown. Somerset East. Graaff Reinet. Middleburg. Albert. Komgha. Natal. Griqualand West. Orange Free State (Leeuw Spruit, Vredefort). Transvaal (Upper Molapo River).

SESUTO: *Bōhōmenyana*. See *Cynoglossum enerve*, also note.

## ANCHUSA, Linn.

**A. capensis**, Thunb.

Damp spots. 15-20 in. high, flowers dark blue. Summer. *A. Dieterlen*, 341!

DISTRIBUTION: Namaqualand Minor. Malmesbury. Swellendam. Albany. Queenstown. Carnarvon. Beaufort West. Aliwal North.

SESUTO: *Pètłèkhèmè*. Meaning unknown. The young plant is eaten as a vegetable.

## MYOSOTIS, Linn.

**M. graminifolia**, DC.

Wittebergen, 6-7000 ft., *Drège*.

DISTRIBUTION: Endemic.

**M. Galpinii**, C. H. W.

Mountain Kloof at Rhodes, 6200 ft., *Galpin*, 2329.

DISTRIBUTION: Endemic.

**M. sylvatica**, Hoffm.

Bester's Vlei, near Witzie's Hoek, 5400 ft., *Bolus*, 8214; Natal, by streams on the Drakensbergen, 6-7000 ft., *Evans*, 396a (*Evans* 396 according to Wood's Natal List).



DISTRIBUTION: Knysna. Queenstown. Graaff Reinet. Transvaal?

**M. afropalustris**, C. H. W.

Damp spots on mountain slopes. 6–20 in. high, flowers blue. Spring–Summer. *A. Dieterlen*, 326a! 326b!; ravine, flowers blue, *Phillips*, 747! 600! 781!; Wittebergen, *Cooper*, 641.

DISTRIBUTION: Knysna. Natal.

SESUTO: *Bōhōmenyana*. See *Cynoglossum enerve*.

var. **glabra**, C. H. W.

Basutoland, without precise locality, *Cooper*, 942.

DISTRIBUTION: Pondoland. Natal. Orange Free State (no locality).

LITHOSPERMUM, *Linn.*

**L. papillosum**, Thunb.

Caledon River, *Burke*.

DISTRIBUTION: Alexandria. Queenstown. Cathcart. East Griqualand.

**L. cinereum**, DC.

Veld and mountain slopes. 6–22 in. high, flowers white. Summer. *A. Dieterlen*, 154!; hills near Harrismith, 5–6000 ft., December, flowers white, *Wood*, 5756!; Wolve Kop, *Burke*.

DISTRIBUTION: Queenstown. Somerset East. Graaff Reinet. Natal. Griqualand West. Orange Free State (no locality). Transvaal (Johannesburg, Molappo River).

CONVOLVULACEAE.

IPOMOEA, *Linn.*

**simplex**, Thunb.

Veld and mountain slopes. 2–4 in. high, flowers white. Summer (January–February). *A. Dieterlen*, 557!

DISTRIBUTION: Uitenhage. Alexandria. Albany. Queenstown. Komgha. Tembuland. Natal. Orange Free State (Bethlehem). Transvaal (near Johannesburg).

SESUTO: *Seakhoè*. *Seakhoa*. *Sehvakhe*. Meanings unknown. The raw roots are chewed by shepherds.

**I. argyreoides**, Choisy.

Near the Caledon River, *Burke*.

DISTRIBUTION: Albany. Fort Beaufort. Cathcart. Queenstown. Somerset East. Graaff Reinet. Cradock. Colesberg. Albert.

Philipstown. Natal. Griqualand West. Orange Free State (Vredefort). Transvaal (Maquasi Hills, Magaliesberg).

**. Greenstockii**, Rendle.

Basutoland, without precise locality, *Cooper*, 2778.

DISTRIBUTION: Somerset East. Natal. Transvaal (Magaliesberg, Pilgrim's Rest, near Johannesburg).

**I. ovata**, E. Mey.

Basutoland, without precise locality, *Cooper*, 2779.

DISTRIBUTION: Transkei. Natal. Transvaal (Greyling.)

**I. angustifolia**, Jacq.

Orange Free State, Wolve Kop, *Burke*.

DISTRIBUTION: Natal. Bechuanaland (near source of Kuruman River, near Hamaprey). Transvaal (Magaliesberg, Marico District, Johannesburg, Pilgrim's Rest).

**I. crassipes**, Hook., var. **longepedunculata**, Hallier, f.

Veld. 8-20 in. high, flowers carmine. Summer. *A. Dieterlen*, 452!; Natal, Van Reenen's Pass, 5-6000 ft., *Wood*, 4524!; Bester's Vlei, near Witzie's Hoek, 5300 ft., December, flowers red, *Bolus*, 8218!

DISTRIBUTION: Orange Free State. Transvaal (near Crocodile River, High Veld, near Pretoria, near Johannesburg).

SESUTO: *Mothōkhvana*. The small "Mathōkhō." *Maime*. Medicine. *Sekulle*. Derived from the verb "ho putla"—to cut in two. Used by the witch-doctors as a charm to prevent harm befalling villages.

**I. oblongata**, E. Mey., var. **hirsuta**, Rendle.

Veld and mountain slopes. A creeper, 15-30 in. long, flowers magenta. Summer. *A. Dieterlen*, 311!; slopes above the Mission Station, a prostrate creeper growing in sand, flowers magenta, *Phillips*, 538!; south slopes of Leribe plateau, above Khaniane, *Phillips*, 903!; Qoqolosi Peak, *Phillips*, 962!; Caledon River, *Burke*.

DISTRIBUTION: Natal. Transvaal (Houtbosch, Magaliesberg).

SESUTO: *Mothōkhō*. Meaning unknown. The leaves, mixed with tobacco, are used as snuff. The smoke from the burning plant is supposed to drive away lightning.

**I. quinquefolia**, Hochst.

Sandy spots on mountain slopes. A prostrate creeper. 12-40 in. long, flowers pale yellow. Summer. *A. Dieterlen*, 786!

DISTRIBUTION: Natal (sandy flats near Mooi River, 3-4000 ft.).

SESUTO: *Lerakallana*. The small stretched one.

CONVOLVULUS, Linn.

**C. hastatus**, Thunb.

Veld and mountain slopes. 8-25 in. high, flowers white. Summer. *A. Dieterlen*, 97b !

DISTRIBUTION : Clanwilliam. Mossel Bay. Uitenhage. Port Elizabeth. Albany. Bathurst. Somerset East. Richmond. Transvaal (Lydenburg).

SESUTO : *Morarana o monyenyané*. The very small creeper. A medicine is prepared from this to ease pregnant women.

**C. ulosepalus**, Hallier f.

Veld and mountain slopes. A creeper or climber. 3-5 ft. long, flowers white. Spring-Summer. *A. Dieterlen*, 97a !; Natal, Weenen County, 3-5000 ft., *Sutherland*.

DISTRIBUTION : Albany. Fort Beaufort. Queenstown. Ceres. Beaufort West. Murraysburg. Graaff Reinet. Richmond. Hope-town. Colesberg. Albert. Somerset East. Griqualand West. Transvaal (near Lydenburg).

SESUTO : *Moroto oa poho*. The urine of the bull. *Morarana o monyenyané*. See *C. hastatus*. *Schoëtè sa nōka*. The carrot of the river. Used for similar purposes as *C. hastatus*.

**C. boedeckerianus**, Peter.

Near the Caledon River, *Burke*, *Zeyher*, 1227.

DISTRIBUTION : Colesberg. Hopetown. Griqualand West. Transvaal.

**C. capensis**, Burm. f., var. *plicata*, Baker.

Veld and mountain slopes. A creeper, 6-25 in. long, flowers white. Summer. *A. Dieterlen*, 387 !; Qoqolosi Peak, a creeper, flowers white, *Phillips*, 966 !; near the Caledon River, *Burke*.

DISTRIBUTION : Riversdale. Mossel Bay. Uniondale. Port Elizabeth. Albany. Queenstown. Graaff Reinet. Albert. Transvaal (Hooge Veld).

SESUTO : *Tiea maghekvana*. Hold fast old women ! (Given as a warning to old people who trip over this creeper.) *Liselo*. That which is looked for.

FALKIA, Linn.

**F. repens**, Linn. f., var. *villosa*, Baker.

Nieuwjaars Spruit between the Orange and Caledon River. *Zeyher*.

DISTRIBUTION : Cape. Uitenhage.

## SOLANACEAE.

## SOLANUM, Linn.

**S. nigrum**, Linn.

Veld and mountain slopes. 5-30 in. high, flowers white. Summer. *A. Dieterlen*, 157!; ravine on west slopes of Leribe plateau, flowers white, *Phillips*, 632!; Qoqolosi Peak, *Phillips*, 943!

DISTRIBUTION: S.W. Africa. Malmesbury. Paarl. Cape. Caledon. George. Uitenhage. Fort Beaufort. Somerset East. Murraysburg. Richmond. Herbert. Komgha. Transkei. Tembuland. Natal. Transvaal (Matebe).

SESUTO: *Seshoa Bohloko*. Meaning unknown. The young plant is cooked as spinach. The ripe fruits are edible. The burnt and powdered roots are rubbed into incisions made on the lower part of the back as a cure for lumbago.

**S. supinum**, Dunal.

Roadsides and mountain slopes. 3-15 in. high. Summer. *A. Dieterlen*, 533!

DISTRIBUTION: Albany. Queenstown. Somerset East. Graaff Reinet. Herbert. Griqualand West. Orange Free State (near the Orange River).

SESUTO: *Moghinyetsane*. He who crushes a soft thing. The crushed fruits are put into fresh milk to make it sour. At a heathen wedding, the crushed roots are placed on the undigested grass from the stomach of an ox (or oxen) which has been killed for the feast. This rite is supposed to protect the newly married couple from being harmed by enemies of the family.

**S. aculeatissimum**, Jacq.

Mountain slopes and plateau. 18-30 in. high, flowers white. March. *A. Dieterlen*, 887!; Natal, near Van Reenen's Pass, 5500 ft., *Wood*, 4515.

DISTRIBUTION: Uitenhage. Humansdorp. Somerset East. Transkei. Pondoland. Natal.

SESUTO: *Thōla e meutloa*. The round prickly thing.

**S. panduraeforme**, E. Mey.

Slope of the Tsikoane Mountain, Leribe District, and also at Leribe, 6-18 in. high, flowers white or violet. Autumn (November). *A. Dieterlen*, 433! (*ex parte*), 928! 713! (*ex parte*); Thaba Unchu, February, *Burke*, 415!

DISTRIBUTION: Transkei. Tembuland. East Griqualand. Natal.

Griqualand West. Orange Free State (Modder River). Bechuanaland (Barolong Territory). Transvaal (near Pretoria, near Johannesburg, near Barberton, near Lydenburg).

SESUTO: *Thōlana*. The small "Thōla" (round thing). "Thōla" is the name of many *Solanaceae*; it refers to the spherical shape of the fruit. A medicine for toothache.

**S. tomentosum**, Linn.

Mountain slopes. 15-30 in. high, flowers mauve. Summer-Autumn. *A. Dieterlen*, 478! 433! (*ex parte*).

DISTRIBUTION: Namaqualand Minor. Clanwilliam. Worcester. Paarl. Cape. Caledon. Swellendam. Knysna. Humansdorp. Uitenhage. Albany. Fort Beaufort. Queenstown. Prince Albert. Somerset East. Beaufort West. Colesberg. Fraserburg. Natal. Orange Free State (Orange River).

SESUTO: *Thōla e nyenyane*. The small "Thola." A medicine for sore throat.

**S. incanum**, Linn.

Veld, mountain slopes and plateau. 10-35 in. high, flowers white or mauve. Summer. *A. Dieterlen*, 103! 713!; mountain slopes above the Mission Station, spreading bush, 1-3 ft. high, flowers bluish, common, *Phillips*, 537!; Bester's Vlei, near Witzie's Hoek, 5300 ft., *Bolus*, 8219.

DISTRIBUTION: Somerset East. Bedford. Fort Beaufort. Queenstown. Somerset East. Tembuland. Pondoland. Natal. Orange Free State (near Orange River, Vredefort). Bechuanaland (Barolong Territory). Transvaal (near Lydenburg, near Johannesburg).

SESUTO: *Thōla*. See *S. panduraeforme* and *S. tomentosum*.

Madame Dieterlen's No. 103 has the leaves densely tomentose above and agrees with a specimen collected by Dr. Kolbe at Salisbury which is labelled *S. incanum*, Linn., in the Bolus Herbarium.

**S. capense**, Linn.

Dry places on veldt and by roadsides. 4-12 in. high, flowers white. Summer. *A. Dieterlen*, 136!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*!

DISTRIBUTION: George. Knysna. Humansdorp. Alexandria. Albany. Fort Beaufort. Queenstown. Prince Albert. Somerset East. Graaff Reinet. Victoria West. Pondoland. East Griqualand. Natal. Transvaal (near Johannesburg).

SESUTO: *Monyaku*. Meaning unknown. *Moghinyetsane*. For meaning see *S. supinum*. Used to sour milk.



PHYSALIS, *Linn.***P. peruviana**, *Linn.*

Lefi's Kloof, N.E. slopes of Leribe plateau, flowers yellow with a dark centre, *Phillips*, 845 !; Basutoland, Mequatleng, *Cooper*, 710 !

DISTRIBUTION: Cape. Knysna. Transvaal (near Lydenburg).

This is the "Cape Gooseberry."

WITHANIA, *Pauq.***W. somnifera**, *Dun.*

Mountain slopes. 10-40 in. high, flowers cream. Summer. *A. Dieterlen*, 14 !

DISTRIBUTION: S.W. Africa. Cape. Swellendam. Oudtshoorn. Uitenhage. Alexandria. Albany. Somerset East. Fraserburg. Beaufort West. Graaff Reinet. Aliwal North. Tembuland. Natal. Griqualand West. Transvaal (Wonderboom Poort, Lebombo Mountains).

SESUTO: *Moferangope*. He who overhangs a donga. *Bofepha*. Meaning unknown. The natives believe that through witchcraft a small reptile ("nōhana") may be introduced into the body. To get rid of this animal a decoction of the plant is either drunk or taken as an enema, or the burnt plant is powdered, mixed with fat, and the anus rubbed with the mixture. Madame Dieterlen states that it is only since the Morosi war of 1879 that this belief has gained currency in Basutoland.

NICANDRA, *Adans.***N. physaloides**, *Gaertn.*

Mountain slopes and as an escape in gardens. 5-38 in. high, flowers mauve. Summer. *A. Dieterlen*, 621 !

DISTRIBUTION: Natal. Transvaal (Pretoria, near Lydenburg).

SESUTO: *Linyooko*. Gall bladders (in reference to the shape of the calyx).

LYCIUM, *Linn.***L. acutifolium**, *E. Mey.*

Mountain slopes. Shrub, 5-8 ft. high, flowers mauve. Autumn, Cana, Tejatejanay District. *A. Dieterlen*, 9 ! (*ex parte*).

DISTRIBUTION: Transkei. Tembuland. Natal.

SESUTO: *Moretlo*. *Moretloa*. Meanings unknown. The smoke from the burning plant is supposed to drive away an approaching hailstorm.

**L. Kraussii**, Dunal.

River banks, veld and mountain slopes. Bush, 2-5 ft. high, flowers pale mauve. Summer-Autumn. *A. Dieterlen*, 11!

DISTRIBUTION: Uitenhage.

SESUTO: *Mosukutsoane*. Meaning unknown. *Moferefere*. Trouble. Parts of the plant are smoked as a cure for headache. The branches are burnt and crushed, and the powder rubbed into incisions made on the hands or feet as a cure for rheumatism.

**L. sp. nov. ?**

*Branches* pilose. *Leaves* solitary, 1-2 cm. long, about 1 cm. broad, elliptic, acute, narrowed into a short petiole below, pilose. This was a single specimen without flowers, mounted on the same sheet as *Dieterlen*, No. 9.

DATURA, *Linn.*

**D. Stramonium**, Linn.

Mountain slopes and near villages. 8-42 in. high, flowers white or mauve. Summer. *A. Dieterlen*, 91!

DISTRIBUTION: Cape. Colesberg. Transvaal (Pretoria, Lydenburg).

SESUTO: *Lechoe*. *Letjoi*. Meanings unknown. A decoction is prepared from the plant with which to bathe bruises. Although a weed, this plant is found in native villages, where it serves as a shelter for chickens that would otherwise fall an easy prey to the hawks.

NICOTIANA, *Linn.*

**N. glauca**, R. Graham.

Kloofs and mountain slopes. Shrub, 6-9 ft. high, flowers yellow. Autumn. Fubane, Leribe District. *A. Dieterlen*, 849!

DISTRIBUTION: Common as an escape throughout South Africa.

SESUTO: *Tabaka Bume*. Tobacco tree (Dutch—"Tabak Boem").

**N. rustica**, Linn.

A cultivated plant. 15-35 in. high, flowers yellow. Summer-Autumn. *A. Dieterlen*, 45!

DISTRIBUTION: Introduced.

SESUTO: *Koae*. Tobacco. The leaves are smoked, also made into a snuff. Given to children with a cold in the head to make them sneeze.

## SCROPHULARIACEAE.

DIASCIA, *Link. & Otto.***D. rotundifolia**, Hiern.

Natal, Polela, 4-5000 ft., March, *Wood*, 4582!

DISTRIBUTION: Endemic.

**D. Barberae**, Hook. f.

Roadside in the Caledon Pass, leading from Witzie's Hoek into Basutoland, c. 7875 ft., December, flowers pink, *Thode*, 40!; Tsitsa Footpath, 7600 ft., March, flowers pink, *Galpin*, 6784!; in Pot River Berg Forest, 5500 ft., *Galpin*, 6785!

DISTRIBUTION: Somerset East.

**D. cordata**, N. E. Br.

Natal, Tiger Cave Valley, 6-7000 ft., *Evans*, 382; Polela, 4-5000 ft., *Wood*, 4582!; Giant's Castle Mtn., 6000 ft., *A. Bolus in Herb Guthrie*, 4877! partly.

DISTRIBUTION: Endemic.

**D. integerrima**, E. Mey.

Mountain slopes. 1-3 ft. high, flowers bright pink. Summer. *A. Dieterlen*, 369!; in scrub below Buffalo River Waterfall, c. 7100 ft., March, flowers pink, *Galpin*, 6782!; Basutoland, without precise locality, *Cooper*, 743!; rocky places on the Wittebergen, 6-7000 ft., *Drège*, 3606c.; Wolve Kop, *Burke*.

DISTRIBUTION: Queenstown. Middleburg (Cape). East Griqualand.

SESUTO: *Bolao ba litoèba*. The love philtre of the mice. Use unknown.

**D. capsularis**, Benth.

Slope of Makhoarane Mtn., Morija District, 6-20 in. high, flowers bright pink. Autumn (April). *A. Dieterlen*, 983!

DISTRIBUTION: Uitenhage. Alexandria. Albany. Somerset East. Graaff Reinet. Albert. Colesberg. Stockenström. Tembuland.

SESUTO: *Malan'a konyana a maholo*. The intestines of the big lamb. *Bolao ba litoèba bo boholo*. The big love philtre of the mice.

**D. purpurea**, N. E. Br.

Drakensbergen, in Tiger Cave Valley, among grass, 6-7000 ft., *Evans*, 377. Very rare.

DISTRIBUTION: Endemic.

**D. rigescens**, E. Mey.

Mountain slopes. 6-30 in. high. flowers pink. Summer. Malavaneng, Leribe District, *A. Dieterlen*, 874!; Mont-aux-Sources, 6000 ft., October, *A. Bolus in Herb. Guthrie*, 4877! partly.

DISTRIBUTION: Stockenstroom. Bathurst. Cathcart. Albany. King William's Town. Stutterheim. Queenstown. Tembuland. East Griqualand. Pondoland.

SESUTO: *Boloa ba litoèba*. The love philtre of the mice.

NEMESIA, Vent.

**N. floribunda**, Lehm.

Van Reenen's Pass, 5-6000 ft., *O. Kuntze*.

DISTRIBUTION: Cape. Riversdale. Uitenhage. Port Elizabeth. Albany. Cathcart. Stutterheim. Fraserburg.

**N. diffusa**, Benth.

Caledon River, *Zeyher*, 1263.

DISTRIBUTION: Namaqualand Minor. Cape. Knysna. Stockenstroom. Alexandria. Cradock. Tembuland. Hope Town?

**N. foetens**, Vent.

Veld and mountain slopes. 5-20 in. high, flowers pink. Spring-Summer. *A. Dieterlen*, 100!; Bester's Vlei, near Witzie's Hoek, 5250 ft., December, flowers pink or white. *Bolus*, 8224! 8225!, *lanagan*, 1869!; Mont-aux-Sources, 7-8000 ft., January, flowers purple, *Flanagan*, 2083!; Doodman's Kraus Mtn. and Ben McDhui, 8900-9000 ft., March, *Galpin*, 6787, 6788; Leribe Common, flowers pink, lip yellow, *Phillips*, 523! 541! 678! 922! 931! 958!

DISTRIBUTION: Uitenhage. Humansdorp. Albany. Queenstown. Prince Albert. Somerset East. Graaff Reinet. Murraysburg. Beaufort West. Sutherland. Fraserburg. Aliwal North. Albert. Prieska. Griqualand West. King William's Town. Transkei. Tembuland. Natal. Orange Free State (Bethulie, Vaal River). Transvaal (Heidelberg, near Pretoria, near Johannesburg, near Barberton).

SESUTO: *Malan 'a Konyana*. The intestines of the lamb.

var. **latifolia**, Hiern.

Mountain slope, Leribe Mtn. above 'Matalane water-course. Flowers pale pink. Summer. *A. Dieterlen*, 300a!; Cathkin Peak, 8-10,000 ft., November, flowers yellow, *A. Bolus in Herb. Guthrie*, 4876!

DISTRIBUTION: Cape. Albert. East London. Natal. Orange Free State. Transvaal (Rhenoster Kop, Oliphant's River).

SESUTO: *Malan 'a Konyana*. The intestines of the lamb.

**N. melissaefolia**, Benth.

Mont-aux-Sources, 8000 ft., April, *E. Dyke in Herb. Marloth*, 5415 ! and in *Herb. Musei Austro-Afric.*, 5490 !; near Buffalo River Waterfall, 7100 ft., March, *Galpin*, 6786.

DISTRIBUTION: Knysna. Uitenhage. Alexandria. Albany. Fort Beaufort. Queenstown. Somerset East. Colesberg. Stutterheim. East Griqualand. Pondoland. Natal. Orange Free State.

**N. pubescens**, Benth.

Mountain slopes. 5-30 in. high, flowers pale mauve. Spring-Summer. *A. Dieterlen*, 300 !

DISTRIBUTION: Uniondale. Graaff Reinet. Prince Albert. Albert. Hanover. Tembuland. Natal.

SESUTO: *Bohōme ba litoala*. The intestines of the lamb.

var. **glabrior**, Benth.

Thaba Unchu, *Burke*.

DISTRIBUTION: Graaff Reinet. Middleburg (Cape).

**N. albiflora**, N. E. Br.

Foot of Mont-aux-Sources, near Eland's River, 6800 ft., January, *Flanagan*, 2105 !; Drakensbergen, 6-7000 ft., *Evans*, 58.

DISTRIBUTION: Albert. Orange Free State (Bethlehem).

## DICTIS, Benth.

**D. reptans**, Benth.

Damp and shady spots in ravines and mountain slopes. 3-20 in. high, flowers white or pale mauve. Spring-Autumn. *A. Dieterlen*, 242 ! 329 !; rocky places at Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8223 !; *Flanagan*, 1862 !; Natal, Van Reenen, 5600 ft., March, *Schlechter*, 6982 !

DISTRIBUTION: George. Knysna. Alexandria. Port Elizabeth. Bathurst. Albany. Fort Beaufort. Cradock. Stockenström. Komgha. Transkei. Tembuland. Pondoland. Natal. Transvaal (Spitzberg, Vaal River, near Crocodile River).

SESUTO: *Pōnye*. Meaning unknown. *Koenana*. The small crocodile.

## LINARIA, Tournef.

**L. vulgaris**, Mill.

Slopes of Eland's River Mountains, 6600 ft., *Schlechter*, 4003.

DISTRIBUTION: Introduced.



HALLERIA, Linn.

**H. lucida**, Linn.

Among rocks on mountain slopes. Shrub, 1-4 ft. high, flowers reddish-brown. Spring. *A. Dieterlen*, 179!; Basutoland, without precise locality, among rocks, flowers yellow, *Cooper*, 701!

DISTRIBUTION: Clanwilliam. Worcester. Paarl. Cape. Caledon. Swellendam. Uitenhage. Bathurst. Albany. Somerset East. Wodehouse. Port Elizabeth. King William's Town. Stockenström. East Griqualand. Natal. Transvaal (Pretoria, Lydenburg).

SESUTO: *Lebetsa*. He who throws. In spring the plant is burnt and the ashes mixed with fat. The mixture is smeared on pegs which are placed in the ground round the village and cultivated lands as a charm against evil. This custom is renewed every year for each heathen village. In autumn the fruits are buried in the ground to hasten their ripening. Native children suck the juice from the flowers.

PHYGELIUS, E. Mey.

**P. capensis**, E. Mey.

Banks of Caledon River, Leribe District. 20-45 in. high, flowers bright red. Summer. *A. Dieterlen*, 456!; Eland's River Valley, near Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2018! 2019!; streamlet, near Buffalo River Waterfall, 7800 ft., March, flowers red, *Galpin*, 6790!; Basutoland, without precise locality, *Cooper*, 2818; by streams on Wittebergen, 5-7000 ft., *Drège*, 7875.

DISTRIBUTION: Albany. Stockenström. Bedford. Queenstown. Somerset East. Graaff Reinet. Murraysburg. Albert. East Griqualand.

SESUTO: *Mafifi-matšō*. Black darkness (so named because the plant turns black when dried). *Metsi-matšō*. Black water. The powder from the burnt roots is placed in incisions made on the body to cure numbness in the limbs. Used by witch-doctors as a charm against hail damaging the crops.

**P. aequalis**, Harv.

Eland's River Mtn., 7600 ft., *Schlechter*, 3848; Eland's River, near the Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2019!; Basutoland at 8000 ft., *Sanderson (Mellish)*, 645.

DISTRIBUTION: Natal. Transvaal (MacMac, Barberton, Lydenburg).

BOWKERIA, Harv.

**B. simplicifolia**, MacOw.

Eland's River, near the Mont-aux-Sources, 6000 ft., *Flanagan*, 2000; Van Reenen, 5-6000 ft., *Wood*, 5256.

DISTRIBUTION: Stockenström. Queenstown. King William's Town. Tembuland. East Griqualand.

**B. triphylla**, Harv., var. **pubescens**, O. Kuntze.

Van Reenen, 5-6000 ft., *Kuntze*.

DISTRIBUTION: Endemic.

#### MANULEA, Linn.

**M. bellidifolia**, Benth.

Ben McDhui, 9300 ft., March, *Galpin*, 6805!; stony and rocky places on the Wittebergen, 7-8000 ft., *Drège*, 7919d.

DISTRIBUTION: Alexandria. Bathurst. Albany. Queenstown. Somerset East.

**M. thodeana**, Diels.

Mont-aux-Sources, 7-8000 ft., *Thode*, 72.

DISTRIBUTION: Endemic.

**M. crassifolia**, Benth.

Veld and mountain slopes. 10-30 in. high, flowers white. Spring-Autumn. *A. Dieterlen*, 24!; damp spots on mountain slopes. 10-20 in. high, flowers crimson and pink. Summer. Cana. *A. Dieterlen*, 309!; frequent round Leribe plateau, flowers white, *Phillips*, 571! 642! 869! 960!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, flowers white, *Bolus*, 8229!; near Harrismith, *Wood*, 4808; Caledon River, *Zeyher*, 1281! Witteberg Range, *Drège*; Natal, Drakensbergen Range, *Evans*, 381.

DISTRIBUTION: Somerset East. Graaff Reinet. Murraysburg. Beaufort West. Wodehouse. Molteno. Albert. Aliwal North. Transkei. East Griqualand. Natal. Transvaal (near Kloete, near Middleburg, Carolina).

SESUTO: *Fukuthoane*. Meaning unknown. *Nohan' a metsana*. The small snake of the little water. A preparation is made from this and applied to swollen navels in infants.

**M. paniculata**, Benth.

Mountain slopes, near rocks. 15-40 in. high, flowers cream or yellow. Summer-Autumn. *A. Dieterlen*, 436!; Caledon River, *Zeyher*, 1280!; mountain slopes, south of Mission Station, flowers white, *Phillips*, 689!; slopes south of Leribe plateau, above Khaniane, flowers white, drying reddish-brown, *Phillips*, 916!; Wittebergen, *Cooper*, 1374.

DISTRIBUTION: Somerset East. Wodehouse. Pondoland. East Griqualand. Orange Free State (Wolve Kop, Bethlehem). Transvaal (Standerton, Pretoria, Johannesburg).

**SESUTO:** *Lephōphōma*. That which boils hard. *Bolao*. Philtre.  
*'Ma Machōrōtsa*. The mother of "Machōrōtsa." A strong emetic.  
 As a cure for headache, the head is washed in a lotion prepared from  
 the bruised leaves and branches.

**SUTERA, Roth.**

**S. polelensis, Hiern.**

Drakensbergen, Cathkin Peak, 8000; November, *A. Bolus in Herb. Guthrie*, 4949!; near Polela, 6-7000 ft., *Evans*, 518.

**DISTRIBUTION:** Endemic.

**S. caerulea, Hiern.**

Basutoland, near Buffalo River Waterfall, 8250-8400 ft., March, *Galpin*, 6800, 6801!; Natal, Mohlamba Range, 5-6000 ft., *Sutherland*; Van Reenen's Pass and Charlestown, 5-6000 ft., *O. Kuntze*; Caledon River, *Burke*, 222.

**DISTRIBUTION:** Van Rhynsdorp. Worcester. Cape. Swellendam. Riversdale. Mossel Bay. Willowmore. Humansdorp. Wodehouse. Komgha. Orange Free State (Bloemfontein). Transvaal (Oliphant's River, Botsabelo, Magaliesberg, Wonderfontein, Belfast, Lydenburg).

**S. neglecta, Hiern.**

Mountain slopes and plateau. 6-20 in. high, flowers mauve-pink. Summer. *A. Dieterlen*, 421!; Mont-aux-Sources, 8000 ft., April, *E. Dyke in Herb. Marloth*, 5412!; in *Herb. Musei Austro-Afric.*, 5488!; Van Reenen, 5000 ft., March, *Schlechter*, 6922! 5-6000 ft., *Wood*, 4563; mountain slopes, above Mission Station, flowers mauve, *Phillips*, 630!; mountain slopes, south of Mission Station at the side of a stream, flowers mauve, *Phillips*, 707!; near Harrismith, 5-6000 ft., February, *Wood*, 4817!

**DISTRIBUTION:** Transvaal (Devil's Knuckles, Hoogeveld, Lake Chrissie, Middleburg, near Lydenburg).

**SESUTO:** *Moalōlela*. Meaning unknown.

**S. breviflora, Hiern.**

Drakensbergen, Polela, 5-6000 ft., February, *Evans*, 631!; Drakensbergen Range, *Evans*, 392.

**DISTRIBUTION:** Pondoland. East Griqualand.

**S. brachiata, Roth.**

Slopes of Makhoarane Mount, Morija District. 6-20 in. high, flowers pink. Autumn (April). *A. Dieterlen*, 985!; top of Wittebergen, *Cooper*, 2872.

DISTRIBUTION: Clanwilliam. Piquetberg. Tulbagh. Paarl. Cape. Stellenbosch. Caledon. Bredasdorp. Riversdale. Albany.

SESUTO: *Mopota-mafika*. He who surrounds the rocks. Mixed with *Senecio rhyncholoemus*, a medicine is prepared for use in chest complaints.

**S. floribunda**, O. Kuntze.

Under rocks on mountain slopes. 3-15 in. high, flowers white. Spring-Autumn. *A. Dieterlen*, 325!; under rocks on summit of Pot River Berg, c. 6400 ft., March, *Galpin*, 6802!; Van Reenen's Pass, *O. Kuntze*.

DISTRIBUTION: Pondoland. Tembuland. East Griqualand. Orange Free State (Bethlehem). Transvaal (Houtbosch, Pilgrim's Rest, Waterval, Belfast).

SESUTO: *Boluma*. This is a general name for plants employed to cure chest colds in children. A decoction is prepared from the roots, stems and leaves and given to the child in milk or "pap."

**S. cordata**, O. Kuntze, var. *hirsutior*, Hiern.

Wittebergen, 5-6000 ft., *Drège*.

DISTRIBUTION: Stockenstroom. Tembuland.

**S. latifolia**, Hiern.

Kornet Spruit, between the Orange and Caledon Rivers, 5-6000 ft., *Zeyher*.

DISTRIBUTION: Endemic.

**S. Cooperi**, Hiern.

Basutoland, near Bethesda, *Cooper*, 732.

DISTRIBUTION: Endemic.

**S. aurantiaca**, Hiern.

Veld and mountain slopes. 2-12 in. high, flowers red or yellow. Summer. *A. Dieterlen*, 198!; without precise locality, *Cooper*, 2860; near stream on Leribe plateau, on a damp bank, flowers red, *Phillips*, 799! 805!; hill near Harrismith, c. 5000 ft., February, *Wood*, 4746!; Caledon River, January, *Zeyher*, 1298!; Natal, Drakensberg, *Sutherland*.

DISTRIBUTION: Riversdale. Bathurst. Queenstown. Somerset East. Cradock. Richmond. Aliwal North. Albert. Colesberg. Hay. Herbert. Hopetown. Tembuland. Bechuanaland (Kuruman, Mafeking). Transvaal (Pretoria, Magaliesberg, Lydenburg, Rustenburg, Middleburg).

SESUTO: *Phiri ea hlaha e nyenyane*. The small wolf of the grass. Use unknown.

**S. pristisepala**, Hiern.

Mountain slopes. 8–25 in. high, flowers cream or yellow. Summer. *A. Dieterlen*, 424!; Tsitsa footpath, c. 7250 ft., March, *Galpin*, 6803!; Eland's River Valley, near the Mont-aux-Sources, 6000 ft., January, *Flanagan*, 2085!; Qoqolosi Peak, flowers dark-coloured, leaves glistening when fresh, scented, *Phillips*, 951!

DISTRIBUTION: Endemic.

SESUTO: *Phiri ea hlaha*. The wolf of the grass. Use unknown

**S. crassicaulis**, Hiern.

Wittebergen, *Drège*, 7925, *Cooper*, 597.

DISTRIBUTION: Queenstown. Tarkastad. Graaff Reinet. Aberdeen. Murraysburg. Albert. Colesberg. Natal (near Charlestown, 5000 ft.). Orange Free State (Sand River). Transvaal (near Standerton).

var. **purpurea**, Hiern.

Grassy and stony places near Matela, Basutoland, c. 6450 ft., January, flowers dark purple or lilac, the whole plant strongly scented, *Thode*, 42!; top of Mont-aux-Sources, 11,000 ft., *Evans*, 760.

DISTRIBUTION: Endemic.

**S. mollis**, Hiern.

Near the Caledon River, *Burke*, 441, 368.

DISTRIBUTION: Alexandria. Albany. Bedford. Colesberg. Griqualand West.

**S. filicaulis**, Hiern.

Near rocks on mountain slopes. 4–15 in. high, flowers white. Spring–Summer–Autumn. *A. Dieterlen*, 260!; in rocky places on the Wittebergen, 5–6000 ft., *Drège*, 7924; mountain slopes behind the Mission Station and N.E. slopes of Leribe plateau, 9–12 in. high, flowers white, growing under rocks, common, *Phillips*, 544!, 814!

DISTRIBUTION: Endemic.

SESUTO: *Mopota-mafika*. He who surrounds the rocks. Used as a medicine for chest complaints.

**S. Henrici**, Hiern.

In open places at Bester's Vlei, near Witzie's Hoek, 5400 ft., January. *Bolus*, 8228!

DISTRIBUTION: Tembuland.

**S. atropurpurea**, Hiern.

Slopes of Qoqolosi Peak. Flowers brown. January. *A. Dieterlen*, 938!; a small woody bush, Qoqolosi Peak, *Phillips*, 939!, 950!



DISTRIBUTION : S.W. Africa. Riversdale. Mossel Bay. Albany. Fort Beaufort. Queenstown. Cathcart. Prince Albert. Cradock. Burghersdorp. Beaufort West. Richmond. Herbert. Kimberley. Albert. Transkei. Natal. Bechuanaland (near Takun). Orange Free State. Transvaal (Sandloop, Klippan).

SESUTO : *Phiri ea hlaha ea lōti*. The "high mountain" wolf of the grass. Use unknown.

**S. aspalathoides**, Hiern.

O.F.S., Nieuwejaars Spruit, between the Orange and Caledon Rivers, 4-5000 ft., *Zeyher*.

DISTRIBUTION : Bredasdorp. Riversdale. Uniondale. Knysna. Uitenhage. Port Elizabeth.

**S. sp.**

Basutoland, near Buffalo River Waterfall, 7500 ft., March, *Galpin*, 6804

ZALUZIANSKYA, *F. W. Schmidt*.

**Z. maritima**, Walp.

Mountain slopes. Simple herb, 12-18 in. high, flowers crimson and white. Summer (January). *A. Dieterlen*, 909!; Basutoland, without precise locality, *Cooper*, 2847; slopes of the Mont-aux-Sources, 7000 ft., January, *Flanagan*, 2035!; Ben MacDhui, 9200-9800 ft., *Galpin*, 6795-6798; top of the Wittebergen, *Drège*, 7895; Natal, Oliver's Hoek Pass, 5000 ft., January, *Wood*, 3489.

DISTRIBUTION : Cape. Humansdorp. Stockenström. Cathcart. Stutterheim. King William's Town. Tembuland. East Griqualand. Transvaal (near the Crocodile River, Barberton, near Lydenburg, Pilgrim's Rest).

SESUTO : *Theleli ea lōti*. The "Theleli" of the high mountain. *Lebohlollo*. Meaning unknown. Use unknown.

Madame Dieterlen's 968 is probably this species, but the specimen is very incomplete.

var. **breviflora**, Hiern.

Basutoland, Drakensbergen, *Sanderson*, 647; Natal, near Van Reenen, *Schlechter*, 6988!

DISTRIBUTION : Endemic.

**Z. capensis**, Walp.

Mountain slopes. 3-30 in. high, flowers white and crimson. Summer-Autumn. *A. Dieterlen*, 407!, 427!; west slopes of Leribe plateau, corolla lobes dark red, *Phillips*, 774!; Qoqolosi Peak, tube

brown, lobes dark purple, *Phillips*, 935!, 968!; Bester's Vlei, near Witzie's Hoek, 6000 ft., January, *Flanagan*, 2033!; 5300 ft., December, *Bolus*, 8220!; slopes of the Mont-aux-Sources, 7000 ft., December-January, *Flanagan in Herb. Bolus*, 8221!; Basutoland, without precise locality, *Cooper*, 2843.

DISTRIBUTION: Cape. Knysna. Uitenhage. Port Elizabeth. Albany. Queenstown. Murraysburg. Graaff Reinet. Aliwal North. Albert. Transkei. East Griqualand. Natal. Orange Free State.

SESUTO: *Selala*. He who lies down. *Lebohlollo le lenyenyane*. The small "Lebohlollo." *Theleli*. Derived from "ho thella"—to glide. Use unknown.

**Z. dentata**, Walp.

Damp spots and hollows on plateau. 8-25 in. high, flowers white and crimson. Spring. *A. Dieterlen*, 726!

DISTRIBUTION: Tulbagh. Paarl. Cape. Caledon. Beaufort West. Murraysburg. Komgha.

SESUTO: *Letaabe*. Meaning unknown.

**Z. ovata**, Walp.

Ben McDhui, 9700 ft., March, *Galpin*, 6793; stony places on the Wittebergen, 7-8000 ft., *Drège*.

DISTRIBUTION: Queenstown. Natal (near Charlestown, 5-6000 ft.).

**Z. distans**, Hiern.

Van Reenen's Pass, 5500 ft., *Schlechter*, 6944!; 5-6000 ft., December, flowers white, scarlet beneath, *Wood*, 5171!

DISTRIBUTION: Endemic.

**Z. montana**, Hiern.

Slopes of Malavaneng, Leribe District, flowers white and crimson, November-February, *A. Dieterlen*, 929!, (forma) 959!; Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2032!

DISTRIBUTION: Endemic.

SESUTO: *Letaabe*. Meaning unknown. *Theleli ea lōti*. The "Theleli" of the high mountain.

The flowers in Madame Dieterlen's specimens are smaller than in the type.

**Z. microsiphon**, K. Schum.

Natal, Van Reenen's Pass, 6000 ft., *Kuntze*; Oliver's Hoek Pass. *Kuntze*.

DISTRIBUTION: Endemic.

**Z. crocea**, Schltr.

Basutoland, near Buffalo River Waterfall, 8500 ft., March, *Galpin*, 6791!; top of the Wittebergen, *Cooper*, 614, 2854.

DISTRIBUTION: Queenstown. Albert.

**Z. peduncularis**, Walp.

Veldt and plateau. 2–12 in. high, flowers yellow and brown. Winter and early Spring. *A. Dieterlen*, 191a!, 191b!

DISTRIBUTION: Namaqualand Minor. Bathurst. Albany. Ceres.

SESUTO: *Lemèmèè*. Meaning unknown. Cooked as a vegetable when young.

**Z. alpestris**, Diels.

Mountain slopes. 10–25 in. high, flowers crimson and whitish or cream. Summer–Autumn. *A. Dieterlen*, 772!; roadside in Caledon Pass, leading from Witzie's Hoek into Basutoland, c. 6900 ft., January, flowers orange-coloured, *Thode*, 48!; base of Doodman's Krans Mtn., 8500 ft., March, flowers orange-yellow, *Galpin*, 6799!

DISTRIBUTION: Endemic.

SESUTO: *Lebohlollo*. Meaning unknown.

*Galpin*, 6799, is a depauperated specimen.

**Z. goseloide** Diels.

Stony places close under the summit of the Mont-aux-Sources, c. 8550 ft., January, flowers orange-red, *Thode*, 44!; "cave" at the foot of the Mont-aux-Sources, 6800 ft., January, *Flanagan*, 2034!; Natal, in the valley of the Little Tugela River, 5–6900 ft., *Thode*, 70.

DISTRIBUTION: East Griqualand (Ingeli Mountains).

**Z. Flanaganii**, Hiern.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2036!; Ben McDhui, 9700 ft., March, *Galpin*, 6792!

DISTRIBUTION: Endemic.

MIMULUS, *Linn.***M. gracilis**, R. Br.

Damp spots on veldt and mountain slopes. 5–18 in. high, flowers white. Summer. *A. Dieterlen*, 623!

DISTRIBUTION: Albany. Queenstown. Stockenstrom. Somerset East. Graaff Reinet. Albert. King William's Town. Komgha. Transkei. Natal. Orange Free State. Transvaal (Houtbosch, near Lydenburg).

**SESUTO:** *Sehlapetsu*. Meaning unknown. A medicine prepared from this is taken in cases of irregular menstruation. A lotion for bathing tired and feverish patients is also made from the plant.

**LIMOSELLA, Linn.**

**L. aquatica**, Linn, var. *tenuifolia*, Hook. f.

River bed at Hlotse.  $\frac{1}{2}$ –2 in. high, flowers pale mauve. Spring (October). *A. Dieterlen*, 810!; marsh at base of Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6806; top of Quaqua Mtn., Witzie's Hoek, *Thode*.

**DISTRIBUTION:** Albany. Queenstown. East Griqualand. Natal. Orange Free State. Transvaal (Lake Chrissie, Trigard's Fontein, near Bronkhurst River).

**SESUTO:** *Pua-metsi*. The water mole. Used by the witch-doctor when working the divining bones.

**L. major**, Diels.

Water courses. 2–6 in. high, flowers pale mauve. Spring–Summer. *A. Dieterlen*, 535a!; stream on plateau, flowers white, *Phillips*, 785.

**DISTRIBUTION:** East Griqualand. Natal. Transvaal (Aapie's River, near Johannesburg, Houtbosch, near Lydenburg).

**SESUTO:** *Tsika-metsi*. Around the water. *Yoang ba metsi*. The grass of the water. See note under *L. aquatica*, var.

**L. longiflora**, O. Kuntze.

Van Reenen's Pass, 6000 ft., *Kuntze*, 108.

**DISTRIBUTION:** Endemic.

**L. capensis**, Thunb.

Water courses. 1–2 in. high, flowers mauve. Spring–Summer. *A. Dieterlen*, 535b!; Ben McDhui, 9700 ft., March, *Galpin*, 6807.

**DISTRIBUTION:** S.W. Africa. Malmesbury. Cape. Riversdale. Swellendam. Uitenhage. Queenstown. Sutherland. Albert. Molteno. Middleburg. Graaff Reinet. Orange Free State (Sand River Hills, Zaai Hoek, near Vredefort Road). Transvaal (between Porter and Trigard's Fontein).

**SESUTO:** *Yoang ba metsi bo bonyenyane*. The small grass of the water. *Tsika-metsi e nyenyane*. The small "Tsika-metsi." See note under *L. aquatica*, var.

**L. grandiflora**, Benth.

In standing water on plateau. 2–4 in. high, flowers mauve. Summer–Autumn. *A. Dieterlen*, 682!

DISTRIBUTION : Queenstown. Riversdale. Uitenhage. Bathurst. Richmond. Komgha. Natal. Hay. Orange Free State (Kanon Fontein, Vredefort Road). Transvaal (Vaal River, near Lydenburg).

SESUTO : *Boliba*. Water holes. See note under *L. aquatica*, var.

#### CRATEROSTIGMA, *Hochst.*

##### **C. Wilmsii**, Engl.

Eland's River Valley, at the foot of the Mont-aux-Sources. *Bolus*, 8230.

DISTRIBUTION : Transvaal (MacMac, Houtbosch, Donkerhoek, Hell's Gate, near Johannesburg).

#### VERONICA, *Tournef.*

##### **V. anagallis**, Linn.

Damp spots on the mountain slopes. 2–25 in. high, flowers bluish-mauve. Summer. *A. Dieterlen*, 135!; 507!; ravine on west slopes of Leribe plateau, flowers bluish, *Phillips*, 771!; Basutoland, without precise locality, *Cooper*; Natal, Upper Tugela, January, *Wood*, 3561.

DISTRIBUTION : Namaqualand Minor. Clanwilliam. Malmesbury. Cape. Knysna. Uitenhage. Albany. Fort Beaufort. Queenstown. Graaff Reinet. Beaufort West. Komgha. Transkei. Natal. Griqualand West. Orange Free State (Vredefort Road). Transvaal (Mooi River, near Pretoria, Matebe Valley, Johannesburg). Bechuanaland (Mooye River).

SESUTO : *Moghoboghobo o monyenyane*. The small "Moghoboghobo." *Moghoboghobo*. Meaning unknown.

#### GLUMICALYX, *Hiern.*

##### **G. montanum**, Hiern.

Slopes of the Mont-aux-Sources, 7–8000 ft, *Flanagan*, 2018.

DISTRIBUTION : Endemic.

#### MELASMA, *Berg.*

##### **M. scabrum**, Berg.

Damp spots on mountain slopes. 10–25 in. high, flowers pale yellow with a brown centre. Summer. *A. Dieterlen*, 532!; ravine between the Mission Station and Jonathan's Village, flowers yellow, *Phillips*, 720 bis!; Natal, Van Reenen, *Wood*, 6696; between Trent Kop and Antelope Park, 5000 ft., March, *Galpin*, 6808.

DISTRIBUTION : Worcester. Cape. Stellenbosch. Caledon. Knysna.



Uitenhage. Port Elizabeth. Albany. Somerset East. Stutterheim. Tembuland. Pondoland. Zululand. Transvaal (Spitz Kop, near Barberton, near Lydenburg, Houtbosch).

SESUTO: *Tika-letsä*. Surrounding the lake (or pond). Use unknown.

**M. capense**, Hiern.

Wittebergen, *Drège*; Natal, 4-7000 ft., *Wood*.

DISTRIBUTION: Swellendam. Humansdorp. Uitenhage. Alexandria. Bathurst. Albany. Fort Beaufort. Queenstown. Somerset East. Graaff Reinet. Aliwal North. Colesberg. Albert. Komgha. Natal. Transvaal (Pere Kop, Lydenburg, Houtbosch).

**M. sessiliflorum**, Hiern.

Damp spots on mountain slopes. 4-12 in. high, flowers yellow. Summer. *A. Dieterlen*, 684!

DISTRIBUTION: Clanwilliam. Tulbagh. Worcester. Paarl. Caledon. Knysna. George. Cape. Uitenhage. Port Elizabeth. Albany. Graaff Reinet. Komgha. Tembuland. Pondoland. East Griqualand Natal. Griqualand West.

SESUTO: *Mokhèlè*. The name of a stick decorated with feathers and carried with the shield as a dance ornament. The plant having leaves all along the stem is supposed to resemble the "*Mokhèlè*."

**M. orobanchoides**, Engl.

Mountain slopes. 3-12 in. high, flowers dark yellow. Summer. *A. Dieterlen*, 432a!; Thaba Unchu, *Burke*, 444.

DISTRIBUTION: Somerset East. Graaff Reinet. Aliwal North. Kimberley. Natal. Bechuanaland (Mafeking). Orange Free State (Sand River, near Bethulie). Transvaal (Pere Kop, Lydenburg District, Houtbosch Mtn.).

SESUTO: *Seona*. He who gets spoilt (or withered) quickly. Use unknown.

**M. basuticum**, Phillips, sp. nov. *Herba* parasitica, 10-28 cm. alta. *Caules* scabridi, pilis bulbosis tecti. *Folia* 1-3.5 cm. longa, .7-1.3 cm. lata, ovata, ovato-lanceolata vel lineari-lanceolata, saepe acuminata, apice obtusa, super subtusque dense scabrida pilis bulbosis. *Flores* axillares, in spicam dispositi. *Bracteolae* 7-9 mm. longae, 1.5 mm. latae, lineares, apice acutae, subtus scabridae, intus glabrae. *Tubus calycis* 9 mm. longus, campanulatus, scabridus, intus glaber; lobi 7 mm. longi, basi 4-6.5 mm. lati, ovati, apice acuti, scabridi. *Tubus corollae* 1.3 cm. longus, campanulatus, glaber; lobi 6 mm. longi, 6 mm. lati, ovati, apice obtusi. *Stamina* 4; filamenta 7 mm. longa, linearia,

omnia barbata; antherae 3-3.5 mm. longae, 1.5 mm. latae, oblongae, mucronatae. *Ovarium* 4 mm. longum, 4 mm. latum, globosum, glabrum; stylus 1.4 cm. longus, infra compressus, supra carnosus lingulatusque. *Fructus* 8 mm. longus, 7 mm. latus, globosus, niger; semina 1.5 mm. longa, .5 mm. lata, linearia; testa inflata, membranacea.

A parasitic herb 10-28 cm. high, simple or branched at the base. *Stems* scabrid, with bulbous-base hairs. *Leaves* 1-3.5 cm. long, .7-1.3 cm. broad, ovate, ovate-lanceolate or linear-lanceolate, frequently acuminate, obtuse, densely scabrid above and beneath with bulbous-base hairs. *Flowers* axillary, arranged in a spike. *Bracts* similar to the leaves; bracteoles 7-9 mm. long, 1.5 mm. broad, linear, acute, scabrid without, glabrous within. *Calyx-tube* 9 mm. long, campanulate, scabrous without, glabrous within; lobes 7 mm. long, 4-6.5 mm. broad at the base, ovate-triangular, acute, scabrid without. *Corolla* yellow, distinctly marked with dark veinings; tube 1.3 cm. long, campanulate, glabrous; lobes 6 mm. long, 6 mm. broad, ovate, obtuse. *Stamens* 4; filaments 7 mm. long, linear, all bearded; anthers 3-3.5 mm. long, 1.5 mm. broad, oblong, mucronate. *Ovary* 4 mm. long, 4 mm. broad, globose, glabrous; style 1.4 cm. long, compressed in the lower half, widened into a fleshy tongue-shaped portion above. *Fruit* 8 mm. long, 7 mm. broad, globose, black. *Seeds* numerous, 1.5 mm. long, .5 mm. broad, linear, with a loose transparent veined membranous testa.

Mountain slopes. Flowers yellow. April. *A. Dieterlen*, 432b.

DISTRIBUTION: Endemic.

SESUTO: *Moèmaōsi*. He who stands alone.

Very near *M. capense*, Hiern, from which it can at once be distinguished by the bulbous-base hairs which densely cover the stem and leaves. The flowers closely resemble those of *M. capense*, Hiern, but the stamens are all mucronate, and the upper thickened portion of the style differs slightly. Hiern (*Fl. Cap.* IV, ii, 373) mentions that in *M. capense* "2 of the filaments densely bearded along one side," but I find in a specimen collected by Zeyher at the Zwartkops River, and cited by Heirn as *M. capense*, that all the filaments are bearded.

#### STRIGA, *Lour.*

##### *S. orobanchoides*, Benth.

Fields and mountain slopes. 3-10 in. high, flowers pale pink. Summer. *A. Dieterlen*, 150!; ravine on west slopes of plateau, flowers white, *Phillips*, 618!; Wittebergen, *Drège*.

DISTRIBUTION: S.W. Africa. Uitenhage. Fort Beaufort. Cathcart. Jansenville. Cradock. Graaff Reinet. Komgha. Transkei or Tembuland. Natal.

SESUTO: *Seona*. See *Melasma orobanchoides*. The natives have observed that when this plant appears abundantly in the lands the crops suffer. See articles under "Rooibloem" in the 'Agricultural Journal.'

**S. Thunbergii, Benth.**

Veld and mountain slopes. 6-15 in. high, flowers dark violet. Summer-Autumn. *A. Dieterlen*, 527!; Qoqolosi Peak, flowers pinkish, *Phillips*, 984!; Basutoland, without precise locality, *Cooper*, 2832; Wolve Kop, Thaba Unchu, and the Caledon River, *Burke*; Wittebergen, *Drège*, 2297d.

DISTRIBUTION: Uitenhage. Albany. Fort Beaufort. Queenstown. Cradock. Graaff Reinet. Albert. Stockenstroom. Komgha. Transkei. Pondoland. East Griqualand. Natal. Bechuanaland (near Hamaprey). Orange Free State (Bloemfontein). Transvaal (Johannesburg, near Lydenburg, near Heidelberg, Kudu's Poort, Pretoria, Magaliesberg, Rustenburg).

SESUTO: *Seona*. See *Melasma orobanchoides*.

**S. elegans, Benth.**

Veld, mountain slopes, and plateau. 3-9 in. high, flowers pink or white. Summer. *A. Dieterlen*, 526!; slopes between the Mission Station and Jonathan's Village, flowers pale pink, occasional, *Phillips*, 561!; Thaba Unchu, *Burke*, 443!, *Zeyher*, 1278!; between Kraai River and the Wittebergen, 4-5000 ft., *Drège*, 3591b; Caledon River, *Burke*, 369!

DISTRIBUTION: Albany. Queenstown. Cathcart. Stutterheim. Albert. Komgha. Transkei. Tembuland. Natal. Bechuanaland (at Hamaprey, between Mafeking and Ramoutsa). Transvaal (near Pretoria, Botsabelo, near Standerton, near Lydenburg, near Bronkhurst Road, Johannesburg).

SESUTO: *Seona*. See *Melasma orobanchoides*.

**S. lutea, Lour**

Veld. 3-10 in. high, flowers bright red. Autumn. *A. Dieterlen*, 699!

DISTRIBUTION: Fort Beaufort. Bathurst. East Griqualand. Natal. Delagoa Bay. Bechuanaland (Mafeking). Transvaal (Matabele Valley, near Pretoria, Barberton, near Lydenburg).

SESUTO: *Seona*. See *Melasma orobanchoides*

SOPUBIA, *Hamilt.***S. simplex**, Hochst.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8232!

DISTRIBUTION: Knysna. Uitenhage. Komgha. Pondoland. Tembuland. Natal. Zululand. Transvaal (Magaliesberg, Devil's Kantoor, Heidelberg).

**S. cana**, Harv.

Veld and mountain slopes. 6-18 in. high, flowers pink. Summer. *A. Dieterlen*, 336!; ravine (Lefi's Kloof) on N.E. slopes of Leribe plateau, flowers pink, among grass at the entrance of Kloof, *Phillips*, 852!; Bester's Vlei, near Witzie's Hoek, 5000 ft., December, *Flanagan*, 2087!; *Bolus*, 8233!

DISTRIBUTION: Natal. Swaziland. Transvaal (Barberton, near Lydenburg, Houtbosch, near Pretoria, Wilge River).

SESUTO: *Pulumo-tsoeu*. The white gnu. A decoction made from this plant and *Salvia runcinata* is taken by pregnant women who are threatened with a miscarriage; also used in cases of painful menstruation.

**S. trifida**, *Hamilt.*

Damp spots on mountain slopes. 7-22 in. high, flowers carmine. Summer. *A. Dieterlen*, 443.

DISTRIBUTION: Natal. Transvaal (Hell's Gate, Lydenburg).

SESUTO: *Khōtōtieo ea liliba*. The "Khōtōtieo" of the springs. *Lebohlobo*. Meaning unknown. Use unknown.

BUCHNERA, *Linn.***B. dura**, Benth.

Damp spots on mountain slopes. 6-22 in. high, flowers white. Summer. *A. Dieterlen*, 752!

DISTRIBUTION: Ceres. Worcester. Caledon. Knysna. Uitenhage. Port Elizabeth. Alexandria. Bathurst. Albany. King William's Town. Stutterheim. Komgha. Transkei. Tembuland. Pondoland. Natal. Swaziland. Transvaal (Barberton, Spitzkop, near Middleburg).

SESUTO: *Seona*. See *Melasma orobanchoides*.

**B. reducta**, Hiern.

Mountain slopes and plateau. 3-8 in. high, flowers dark violet. Summer-Autumn. *A. Dieterlen*, 680!

DISTRIBUTION: Transvaal (no locality).

SESUTO: *Seona*. See *Melasma orobanchoides*.

CYCNIIUM, *E. Mey.*

**C. racemosum**, Benth.

Bester's Vlei, near Witzie's Hoek, 6300 ft., December, *Bolus*, 8231!; Nelson's Kop, *Cooper*, 894; Natal, Cathkin Peak, 6500 ft., *A. Bolus* in *Herb. Guthrie*!; Drakensbergen, *Evans*, 355.

DISTRIBUTION: Queenstown. Stockenstroom. Transkei. Tembuland. Pondoland. Natal. Transvaal (Pilgrim's Rest, MacMac, Houtbosch, Barberton).

HARVEYA, *Hook.*

**H. coccinea**, Schltr.

Mountain slopes. 4-15 in. high, flowers pink. Spring-Summer. *A. Dieterlen*, 431!; ravine on West slopes of Leribe plateau, calyx yellow, inside of corolla pale pink, yellow outside, *Phillips*, 629!

DISTRIBUTION: Cape. Bredasdorp. Stockenstroom. Queenstown. East Griqualand. Natal.

SESUTO: *Seona*. See *Melasma orobanchoides*.

**H. pumila**, Schltr.

Mountain slopes.  $1\frac{1}{2}$ - $2\frac{1}{2}$  in. high, flowers dark pink. Spring-Summer. Sebothoane, Leribe District. *A. Dieterlen*, 697!

DISTRIBUTION: Queenstown.

SESUTO: *Mo-shoa-feela*. He who dies.

**H. hyobanchoides**, Schltr.

Mountain slopes, Leribe mountains. 6 in. high, flowers yellow. Summer. *A. Dieterlen*, 430a!

DISTRIBUTION: Albany. Humansdorp.

SESUTO: *Seona*. See *Melasma orobanchoides*.

**H. speciosa**, Bernh.

Mountain slopes and river banks. 5-18 in. high, flowers white. Summer. *A. Dieterlen*, 430!; near the Caledon River, *Burke*, 416, *Zeyher*, 1279; foot of the Wittebergen, *Cooper*, 624.

DISTRIBUTION: Stockenstroom. Bedford. Transkei. Tembuland. East Griqualand. Natal. Transvaal (near Barberton, Spitz Kop).

SESUTO: *Seona*. See *Melasma orobanchoides*. *Mokunyi* Derived from the verb "ho kunya"—to lift up. A medicine supposed to be a cure for madness is prepared from this species.



## LENTIBULARIEAE.

## UTRICULARIA, Linn.

**U. Ecklonii**, Spreng.

Water courses and springs on plateau. Flowers white. Summer. *A. Dieterlen*, 781!

DISTRIBUTION: Namaqualand Minor. Tulbagh. Cape. Caledon. Riversdale. Uitenhage. Somerset East. Graaff Reinet. Bechuana-land. Transvaal (Houtbosch).

SESUTO: *Tlamana sa metsi*. The little water plant. Use unknown.

**U. exoleta**, R. Br.

Natal, Mohlamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: Uitenhage. Transvaal (Magaliesberg, Rustenburg, near Crocodile River, Bosch Veld).

**U. humilis**, Phillips, sp. nov. (Pl. II, fig. B). *Herba* aquatica, 1-2 cm. alta, glabra. *Folia* 1 cm. longa, supra .75 mm. lata, linearia, apice obtusa, basi angustata. *Bracteae* 1 mm. longae, lineares, apice obtusae. *Sepala* 2.5 mm. longa, 1.5 mm. lata, elliptica, apice obtusa. *Corolla* 6 mm. longa; palatum rugosum. *Filamenta* 1 mm. longa; antherae .5 mm. longae. *Ovarium* planum, 1 mm. longum, 1 mm. latum, ellipticum, glabrum; stylus .5 mm. longus; stigma planum, .75 mm. latum.

Small plants 1-2 cm. high. *Branches* glabrous. *Leaves* all radical, about 1 cm. long, .75 mm. broad above, linear, obtuse, narrowing and hyaline towards the base. *Bracts* 1 mm. long, linear, obtuse. *Flowers* solitary, subsessile, 8 mm. long. *Pedicel* 1 mm. long, terete. *Sepals* 2.5 mm. long, 1.5 mm. broad, elliptic, obtuse, deeply concave, glabrous. *Corolla* pink; lower lip 4 mm. long, ovate below, slightly constricted in the middle and then produced into an oblong portion, truncate; upper lip 6 mm. long, hooded, rounded above, produced at the base into a spur 5 mm. long; palate transversely rugose. *Filaments* about 1 mm. long; anthers .5 mm. long. *Ovary* flattened 1 mm. long, 1 mm. broad, elliptic, glabrous; style .5 mm. long, thickened; stigma flattened, 1.75 mm. broad. *Placenta* shortly stalked, about .5 mm. long, .5 mm. broad, ovate, truncate. *Ovules* numerous. Fruit not seen.

Near *U. transrugosa*, Stapf., but differs in the size and shape of the flowers.

Leribe plateau. November. *A. Dieterlen*, 925.

DISTRIBUTION: Endemic.

SESUTO: *Tlamana sa metsi*. The little water-plant.

GESNERACEAE.

STREPTOCARPUS, *Lindl.*

**S. pusilla**, Harv.

Slopes of the Mont-aux-Sources, 8000 ft., January, *Flanagan*, 2099 !; Natal, Drakensberg, near De Beer's Pass, 5-6000 ft., March, flowers light blue, *Wood*, 6021 !; stony places on the Drakensbergen, 5-6000 ft., November, flowers white and pink, *Wood*, 6275 !

DISTRIBUTION: East Griqualand. Transvaal (Carolina).

**S. Rexii**, Lindl.

Orange Free State, Drakensbergen, flowers blue and white, *Cooper*, 1031 !; Natal, Van Reenen, 5500 ft., January, flowers lilac, *Wood*, 10724.

DISTRIBUTION: Somerset East. Stutterheim. East Griqualand. Transvaal (Kaffir Creek).

ACANTHACEAE.

CHAETACANTHUS, *Ness.*

**C. Burchellii**, Ness.

Natal, Van Reenen, 5-6000 ft., November, flowers white, *Wood*, 9722 !; Thaba Unchu, *Burke*.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Trigard's Fontein, near Lydenburg, MacMac, Standerton, Barberton).

BLEPHARIS, *Juss.*

**B. subvolubilis**, C. B. Cl.

Thaba Unchu, *Burke*.

DISTRIBUTION: Transvaal (Barberton).

**B. espinosa**, Phillips, sp. nov. (Pl. II, fig. A). *Planta* prostrata. *Rami* strictis pilis tecti. *Folia* 1-7.5 cm. longa, .3-1.3 cm. lata, lanceolata, elliptico-oblonga vel oblonga, apice obtusa, basi attenuata, glabra, glandulosa. *Inflorescentia* 2-4-florifera, 3-3.5 cm. longa, 2-3.5 cm. lata. *Bractee* 2.5-3 cm. longae, 1-1.2 cm. latae, obovatae, acuminatae, spinosae, glabrae. *Bracteolae* 1.9-2 cm. longae, 2 mm. latae, acuminatae, apice acutae, basi angustatae, glabrae, subtus unicostatae. *Sepalum* anticum 2 cm. longum, supra 5 mm. latum, lineare, apice bidentatum, basi angustatum concavumque, subtus 2-costatum, supra paucis pilis tectum; sepalum posticum 2.3 cm. longum, supra 5 mm. latum, lineare, apice obtusum, scariosumque, subtus 3-4-costatum

pilosumque; sepala interioria 1 cm. longa, basi 4 mm. lata, ovata, acuminata, apice acuta, glabra, supra interdum ciliata. *Corolla* 3 cm. longa, supra 2 cm. lata, infra 7 mm. lata, obovata, intus pilosa, ciliata; lobi 6 mm. longi, 6-7 mm. lati, subrotundi; tubus 7 mm. longus, infra ovoideus, supra constrictus, glaber, sed pars constricta glandulosa. *Filamenta* 8 mm. longa, subteretia, pauce glandulosa interdumque pilosa, aliter glabra; antherae 5 mm. longae, 1.5 mm. late, ciliatae. *Ovarium* 3 mm. longum, subglobosum, glabrum; stylus 1.1 cm. longus, supra subteres, infra paullo compressus, glaber vel supra 5-6 pilis tectus.

A plant with prostrate branches arising from an underground stem. *Branches* up to .5 m. long, sparsely covered with short soft hairs. *Leaves* 1-7.5 cm. long, .3-1.3 cm. broad, lanceolate, elliptic-oblong or oblong, obtuse, narrowed at the base into a petiole up to 1.5 cm. long, glabrous, except for a few hairs on the midrib beneath, glandular. *Inflorescence* 2-4-flowered, 3-3.5 cm. long, 2-3.5 cm. across. *Bracts* 2.5-3 cm. long, 1-1.2 cm. broad, obovate, acuminate, pungent, with 3-4 spines on either side of the margin in the upper half, 3-nerved, glabrous, except for a few hairs on the prominent nerves beneath. *Bracteoles* 1.9-2 cm. long, 2 mm. broad, acuminate, acute, narrowed at the base, glabrous, pinnately veined with a prominent midrib beneath. *Anticous sepal* 2 cm. long, 5 mm. broad above, broadly linear, 2-toothed at the apex, narrowing and concave at the base, prominently 2-nerved beneath, with a few soft hairs on the uppermost third; posticous sepal 2.3 cm. long, 5 mm. broad above, broadly linear, rounded and somewhat scarious at the apex, with margins partly infolded, prominently 3-4-veined and softly hairy beneath; inner sepals 1 cm. long, 4 mm. broad at the base, ovate, acuminate, acute, 1-nerved, glabrous, sometimes with long fine cilia on the margins in the uppermost third. *Corolla* blue, 3 cm. long, 2 cm. broad above, 7 mm. broad below, obovate, hairy within and with ciliated margins; lobes 6 mm. long, 6-7 mm. broad, subrotund; tube 7 mm. long, obovoid below, constricted above and then expanded into a saucer-shaped structure, glandular on the constricted portion, otherwise glabrous. *Stamens* arising from the saucer-shaped portion; filaments 8 mm. long, subterete, with a few minute scattered glands, and sometimes bearing a few hairs, otherwise glabrous; processes of the two anticous filaments curved, 1.5 mm. long, ovate, obtuse; anthers 5 mm. long, 1.5 mm. broad, with a fringe of hairs along the slit. *Ovary* 3 mm. long, subglobose, glabrous, with two glands on the posticous face; style 1.1 cm. long, semi-terete above, gradually widening and compressed below, glabrous, except for 5-6 hairs on the upper half.

Approaches *B. Stainbankiae*, C. B. Cl., and *B. dilatata*, C. B. Cl., but differs from the former in the bracts and calyx being almost glabrous and having blue flowers; from the latter it differs in not having spiny leaf-margins and having differently shaped calyx-lobes.

Roadside at Mokollong, Maseru District. Summer (February) *A. Dieterlen*, 976!

SESUTO: *Mohlalalane*. A small swelling. *Maraptjane*. Meaning unknown. An infusion made from this plant is said to be valued as a cure for colds.

### CRABBEA, Harv.

#### **C. hirsuta**, Harv.

Veld and mountain slopes. 2-5 in. high, flowers pale pink. Summer-Autumn. *A. Dieterlen*, 243!; west slopes of plateau, leaves flat on ground, flowers white, occasional, *Phillips*, 646!

DISTRIBUTION: Alexandria. Komgha. Transkei. East Griqualand. Natal (Ixopo, 4-5000 ft.). Swaziland. Transvaal (Barberton, Johannesburg, near Lydenburg).

SESUTO: *Letsoeyana*. A small breast. *Mereko*. Meaning unknown. This plant is much used by the witch-doctors in conjunction with the divining bones.

### BARBERIA, Linn.

#### **B. ovata**, E. Mey.

Stony hills near Slojoana's Kraal, Witzie's Hoek, c. 6300 ft., January, flowers purple, *Thode*, 45!; Bester's Vlei, near Witzie's Hoek, 5500 ft. January, *Flanagan*, 1988!; near Eland's River, 6300 ft., December, flowers blue, *Bolus*, 8289!; Mont-aux-Sources, 9500 ft., October, flowers purple. *A. Bolus in Herb. Guthrie*, 4889!; mountains of Basutoland, *Thode*!

DISTRIBUTION: Pondoland. Natal. Swaziland. Transvaal (Barberton, near Lydenburg, Spitz Kop, Crocodile River).

### JUSTICIA, Linn.

#### **J. ? Brycei**, C. B. Cl.

Basutoland, near the summit of Machacha, 10000 ft., *Bryce*.

DISTRIBUTION: Endemic.

### ISOGLOSSA, Oerst.

#### **I. Macowanii**, C. B. Cl.

Mountain slopes. 10-40 in. high, flowers white and crimson. Summer. *A. Dieterlen*, 578! 578b!

DISTRIBUTION: Albany. Somerset East. Natal.

SESUTO: *Moholu oa pela*. The stomach of the rock-rabbit. *Bolilana ba linonyana*. The small sorrel (or beer) of the birds. *Ha a na morena*. It has no chief. Use unknown.

## HYPOESTES, R. Br.

**H aristata**, R. Br.

Natal, De Beer's Pass, 5-6000 ft., March, flowers white, *Wood*, 6022!

DISTRIBUTION: Knysna. Humansdorp. Mossel Bay. Robertson. Uitenhage. Port Elizabeth. Albany. Bathurst. King William's Town. Orange Free State. Transvaal (Houtbosch, Barberton).

## SELAGINEAE.

## HEBENSTREITIA, Linn.

**H polystachya**, Harv.

Orange Free State, Drakensberg, *Cooper*, 1014; Natal, Oliver's Hoek, at the sources of the Tugela River, 5000 ft., *Allison*.

DISTRIBUTION: Natal. Transvaal (Spitz Kop, Houtbosch, near Barberton).

**H. Sutherlandi**, Rolfe.

Basutoland, 8000 ft., *Mellish in Sanderson's Herb.*, 634.

DISTRIBUTION: Endemic.

**H. comosa**, Hochst.

Mountain slopes and plateau. 15-38 in high, flowers white and brown, sweet-scented. Summer. *A. Dieterlen*, 247!; ravine on west slopes of plateau, flowers white, *Phillips*, 580! N.E. slopes of plateau, flowers white with a red throat, *Phillips*, 824!

DISTRIBUTION: East Griqualand. Natal. Transvaal (Pilgrim's Rest).

SESUTO: *Tsitvane*. Meaning unknown. Mixed with fat to make a perfumed ointment.

**H. Cooperi**, Rolfe.

Basutoland, near Morija, *Cooper*, 737!

DISTRIBUTION: Endemic.

**H. Cooperi**, Rolfe, forma.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 1991!

DISTRIBUTION: Endemic.



**H. fruticosa**, Sims.

Mont-aux Sources, 8000 ft., April, *E. Dyke in Herb. Marloth*, 5419 ! in *Herb. Musei Austro-Afric.*, 5501 !; Orange Free State, Wolve Kop near the Caledon River, *Burke*.

DISTRIBUTION: Namaqualand Minor. Paarl. Tulbagh. Worcester. Queenstown. East London. Stockenstroom. Somerset East. Tembuland. Natal.

var. *dura*, Rolfe.

Caledon River, *Burke*, 438 !

DISTRIBUTION: Endemic.

**H. dentata**, Linn.

Basutoland, without precise locality, *Cooper*, 3014; near Buffalo River Waterfall, 8200 ft., March, *Galpin*, 6810 !, Ben McDhui, c. 9700 ft., March, *Galpin*, 6811 !

DISTRIBUTION: Van Rhynsdorp. Malmesbury. Clanwilliam. Cape. Tulbagh. Caledon. Albany. Stockenstroom. Queenstown. Transkei. Natal. Transvaal (Lydenburg, Pilgrim's Rest).

var. *integrifolia*, E. Mey.

Natal, Tabanhlope, 6000 ft., October, *Wood*, 105568 !; Cathkin Peak, 10,000 ft., November, *A. Bolus in Herb. Guthrie*, 4078 !

DISTRIBUTION: Clanwilliam. Cape. Queenstown. Graaff Reinet. Molteno. Pondoland.

**H. integrifolia**, Linn.

Mountain slopes. 10-22 in. high, flowers purple and brown. Summer-Autumn, *A. Dieterlen*, 38 !

DISTRIBUTION: Van Rhynsdorp. Clanwilliam. Riversdale. Mossel Bay. Knysna. Uniondale. Uitenhage. Port Elizabeth. Albany. Stockenstroom. Bathurst. Aliwal North. Natal. Bechuanaland. Transvaal (near Lydenberg).

SESUTO: *Lebohlolla*. Meaning and use unknown.

**H. crassifolia**, Choisy.

Orange Free State, Witte Bergen, on shady sides of the mountain *Mrs. Barber* and *Mrs. Bowker*; near the Caledon River, *Burke*.

DISTRIBUTION: Namaqualand Minor. Clanwilliam. Tulbagh. Fraserburg. Sutherland. Beaufort West. Graaff Reinet.

**H. basutica**, Phillips, sp. nov. *Frutex* 15-27 cm. altus. *Rami* foliosi, pubescentes. *Folia* 7-2.2 cm. longa, 1-3 mm. lata, linearia, apice subobtusata, basi angustata, supra serrulata, glabra. *Inflorescentia*

terminalis, 4-6 cm. longa, circiter 1.5 cm. lata, cylindrata. *Bracteae* 6 mm. longae, 2.5 mm. latae, ellipticae, acuminatae, apice subacutae, marginatae, glabrae. *Calyx* 4 mm. longus, 1.5 mm. latus, apice obtusus, marginatus, glaber. *Tubus corollae* 5 mm. longus, cylindricus, glaber; limbus 8 mm. longus, supra 3 mm. latus, planus; lobi 4, oblongi vel lineares, apice obtusi. *Filamenta* 1 mm. longa; *antherae* 1.5 mm. longae. *Ovarium* 1 mm. longum, glabrum; *stylus* 5 mm. longus, teres, glaber; *stigma* minutum. *Fructus* 6 mm. longus, 1.75 mm. latus, apice obtusus, glaber.

A woody shrub 15-27 in. high. *Branches* densely leafy, pubescent in decurrent lines from the leaf-bases, otherwise glabrous. *Leaves* 7-2.2 cm. long, 1-3 mm. broad, linear, subobtuse, narrowed at the base, with the midrib sunk above, remotely serrulate in the upper half or uppermost third, glabrous. *Inflorescence* terminal, 4-6 cm. long, about 1.5 cm. in diameter, cylindric. *Bracts* 6 mm. long, 2.5 mm. broad, elliptic, acuminate, subacute, with narrow membranous margins, glabrous. *Calyx* 4 mm. long, 1.5 mm. broad, concave, obtuse, 2-nerved, with broad membranous margins, glabrous. *Corolla-tube* 5 mm. long, cylindric, glabrous; limb 8 mm. long, 3 mm. broad above, flattened, widened above; lobes 4; the two outer 1.5 mm. long, 1 mm. broad, oblong, rounded above; the two inner 1.5 mm. long, .5 mm. broad, linear, obtuse. *Stamens* on the margins of the corolla limb, 2 on either side; filaments 1 mm. long, glabrous; anthers 1.5 mm. long. *Ovary* 1 mm. long, .75 mm. broad, oblong in outline, glabrous; style 5 mm. long, terete, gradually narrowing upwards, glabrous; stigma minute. *Fruit* 6 mm. long, 1.75 mm. broad, oblong in outline, obtuse, glabrous, subtended by the persistent bract.

Differs from *H. Sutherlandi*, Rolfe, by the larger flowers, and from *H. fruticosa*, Sims, in the leaves being serrulate and not denticulate.

Malavaneng, Leribe District. Flowers cream and reddish. *A. Dieterlen*, 1004

SESUTO: *Tsitoane ea setlolo*. The "Tsitoane" for ointment. Mixed with fat to make a perfumed ointment. Used especially by the wives of chiefs. This is held in greater esteem than *H. comosa* as an ointment.

#### WALAFRIDA, *E. Mey.*

##### *W. apiculata*, Rolfe.

Doodman's Krans Mtn., 8500 ft., March, *Galpin*, 6812!; summit of the Wittebergen, 7-8000 ft., *Drège*.

DISTRIBUTION: Endemic.

**W. witbergensis.** Rolfe.

Wittebergen, among stones and grass, 5-6000 ft., *Drège*.

DISTRIBUTION : Uitenhage.

**W. densiflora,** Rolfe.

Veld, mountain slopes and plateau. 6-22 in. high, flowers white. Summer-Autumn. *A. Dieterlen*, 2a !, 2b !; Tlapaneng, Berea District, *A. Dieterlen*, 2c !; frequent on slopes round Leribe plateau, a low shrub, flowers white, *Phillips*, 512 bis !, 682 !, 709 !, 887 !; Caledon River, *Burke*, 422 ; Ben McDhui, 9700 ft., March, *Galpin*, 6815.

DISTRIBUTION : Aliwal North. Natal. Griqualand West. Bechuanaland. Transvaal (Rustenburg, near Pretoria, Houthbosch, Standerton, near Little Oliphant's River).

SESUTO : *Mophethu*. Meaning and use unknown.

SELAGO, *Linn.*

**S. pachypoda,** Rolfe.

Natal, summit of Amawahqua Mtn., 6800 ft., *Wood*, 4575 ; among stones near Currie's Post, 5000 ft., *Schlechter*, 6807.

DISTRIBUTION : Tembuland. Pondoland. East Griqualand.

**S. Cooperi,** Rolfe.

Natal, De Beer's Pass, 5-6000 ft., March, *Wood*, 5974 !; on the Rovelo Hills at 7000 ft., *Sutherland*.

DISTRIBUTION : Albert. Pondoland.

**S. Sandersoni,** Rolfe.

Basutoland, without precise locality, *Cooper*, 3011 ; below the Montaux-Sources, 7-8000 ft., March, *Evans*, 755.

DISTRIBUTION : Endemic.

**S. Galpinii,** Schltr.

Mountain slopes and plateau. 6-30 in. high, flowers violet or pink, Summer-Autumn. *A. Dieterlen*, 8 !; Botsabelo, near Maseru, 1½-2 ft. high, flowers purple and mauve, May-June. *A. Dieterlen*, 8a !; 1028 !; Tsitsa footpath, Drakensberg, 7000 ft.. March, flowers purple, *Galpin*, 6813 !

DISTRIBUTION : Queenstown, Orange Free State (no locality).

SESUTO : *Tsitoanenyana*. The small "Tsitoane." Use unknown.

**S. lithospermoides.** Rolfe.

Natal, on the Rovelo Hills, 7000 ft., *Sutherland*.

DISTRIBUTION : Endemic.

**S. Flanaganii**, Rolfe.

Slopes of high mountains at Lehonghong. A bush, flowers mauve. Summer. *A. Dieterlen*, 785!; summit of the Mont-aux-Sources, 9500 ft., flowers blue, *Flanagan*, 2108!; Doodman's Krans Mtn., 9650 ft. March, *Galpin*, 6814!

DISTRIBUTION: Endemic.

SESUTO: *Lenyofane-Khōnnōkana*. The "Lenyofane," covered by sand.

**S. Schlechteri**, Rolfe.

Natal, among stones near Currie's Post, 5000 ft., *Schlechter*, 6810; Basutoland, Buffalo River Waterfall, c. 8200 ft., March, flowers white, *Galpin*, 6816!

DISTRIBUTION: Endemic.

**S. albida**, Choisy.

Basutoland, without precise locality. *Cooper*, 3012; Caledon River, *Burke*.

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Queenstown. Calvinia. Prince Albert. Somerset East. Fraserburg. Sutherland. Murraysburg. Graaff Reinet. Aberdeen. Colesberg. Middleburg. Cradock. Albert. Griqualand West. Orange Free State (Bloemfontein).

**S. scabrida**, Thunb.

Kornet Spruit, between the Orange and Caledon Rivers, at the foot of the Wittebergen, 5-6000 ft., *Ecklon* and *Zeyher*.

DISTRIBUTION: Clanwilliam. Piquetberg. Malmesbury. Cape. Stellenbosch. Caledon. Swellendam. Riversdale.

**S. hyssopifolia**, E. Mey.

Natal, common up to 5000 ft.

DISTRIBUTION: Komgha. Tembuland. Pondoland. East Griqualand. Transvaal (Mac Mac, Lydenburg).

**S. monticola**, Wood and Evans.

Natal, on the Drakensberg Range at the sources of the Inyasuti River, 6-7000 ft., *Evans*, 655.

DISTRIBUTION: Endemic.

**S. longipedicellata**, Rolfe.

Malayaneng, Leribe District. 27-39 in. high, flowers pale pink. October-January. *A. Dieterlin*, 932!; 1006!; Bester's Vlei, near Witzie's Hoek, 6400 ft., December, flowers white, *Bolus*, 8236!

DISTRIBUTION: Zululand.

SESUTO: *Mophethu oa lōti*. The "Mophethu" of the high mountain. *Sehala hala sa bophirimela*. The bush of the west. Use unknown.

*S. nutans*, Rolfe.

Wittebergen, in valleys and rugged grassy places. 4500-7500 ft., Drège.

DISTRIBUTION: Endemic.

*S. sp.* (near *S. Schlechteri*, Rolfe).

Basutoland, near the Buffalo River Waterfall, 8200 ft., March. Galpin, 6816.

## VERBENACEAE.

### LANTANA, Linn.

*L. salvifolia*, Jacq.

Slopes of Makhoarane Mountain, Morija, flowers pink. Autumn (April). *A. Dieterlen*, 980!

DISTRIBUTION: Mossel Bay. Uitenhage. Alexandria. Albany. Fort Beaufort. Beaufort West. Graaff Reinet. Cradock. Somerset East. Komgha. Transkei. Tembuland. Natal. Bechuanaland, Orange Free State (Vaal River). Transvaal (Aapie's River, Houtbosch, near Pretoria. Johannesburg).

SESUTO: *Mabèlè mabutsoa pele*. The first ripened Kaffir corn. *Monokotsoai oa makhoaba a matona*. The mulberry of the male crow. One of the strongly rooted superstitions among the Basutos is that if a plant whose fruits ripen early is burnt in the lands, the smoke will cause the grain to also ripen early. This custom is called "mobe seletso." *Lantana salvifolia* is largely used for this purpose.

### BOUCHEA, Cham.

*B. adenostachya*, Schauer.

Orange Free State, low situations on the Witte Bergen, Bowker, 705.

DISTRIBUTION: Griqualand West. Bechuanaland.

### VERBENA, Linn.

*V. venosa*, Gill. et Hook.

Mountain slopes, Morija. 6-20 in. high, flowers purple. Summer-Autumn (April). *A. Dieterlen*, 997!

DISTRIBUTION: Komgha. Transvaal (Lydenburg).

SESUTO: *Morōli*. Derived from the verb "ho rola"—to put down what one carries on the head (e.g. a hat or pot). A decoction of the



roots, which is drunk, is said to be a very valuable medicine for heart burn and colic.

**V. officinalis**, Linn.

Damp and shady spots near Maseru. Flowers violet. Summer-Autumn (December-May). *A. Dieterlen*, 829!

DISTRIBUTION: Cape. Transkei. Tembuland. East Griqualand. Natal. Transvaal (near Lydenburg, near Pretoria, Magaliesberg).

SESUTO: *Seona se sehola*. The big "Seona." ("Seona" means that which withers quickly). Used as fuel in winter when other fuel is scarce.

CLERODENDRON, Linn.

**C. triphyllum**, Pearson.

Veld and mountain slopes. 10-22 in. high, flowers blue. Autumn. *A. Dieterlen*, 515!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1931!

DISTRIBUTION: Orange Free State (near Sand River). Transvaal (near Pretoria, Magaliesberg, near Lydenburg, near Johannesburg, Barberton, Pilgrim's Rest). Natal.

SESUTO: *Mokata*. Meaning unknown. In cases of disease of the kidneys a decoction of the roots is given as an enema.

LABIATAE.

BECIUM, Lindl.

**B. obovatum**, N. E. Br., var. *hians*, N. E. Br.

Orange Free State, Drakensberg Range, *Cooper*, 824.

DISTRIBUTION: Transvaal (many localities), common.

ORTHOSIPHON, Benth.

**O. macranthus**, Guerke.

Natal, Van Reenen, 5400 ft., March, *Schlechter*, 6912!, 5500 ft., December, flowers pink and white, *Wood*, 3573

DISTRIBUTION: Orange Free State (without precise locality).

**O. stenophyllus**, Guerke.

Natal, Mawaqa Mountain, 6-7000 ft., *Wood*, 8126.

DISTRIBUTION: Pondoland, East Griqualand.

**O. Bolusii**, N. E. Br.

Natal, Giant's Castle, Drakensberg Range, 9000 ft., November. *A. Bolus in Herb. Guthrie*, 4894!

DISTRIBUTION: Endemic.

PLECTRANTHUS, *L'Her.*

**P. natalensis**, Guerke, *forma glandulosa*.

Damp spots in ravines and mountain slopes. 10–45 in. high, flowers pale mauve. Summer. *A. Dieterlen*, 417!; growing in shade of rocks, flowers white, *Phillips*, 597!; damp spots in ravine, flowers bluish-white, *Phillips*, 776!, Lefi's Kloof, flowers whitish-pink, *Phillips*, 817!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8238!, *Flanagan*, 1927!

DISTRIBUTION: Endemic.

SESUTO: *Lephelophele*. Meaning unknown. Formerly it was used to wash the sheep-skin coats which were worn by shepherds; even now it is used in the washing of cotton garments when soap is not available. The leaves are glandular-hairy above.

**P. transvaalensis**, Briq.

Orange Free State, Harrismith, 6500 ft., *Sankey*, 231.

DISTRIBUTION: Natal. Transvaal (Houtbosch).

ÆOLANTHUS, *Mart.*

**Æ. canescens**, Guerke.

Mountain slopes, growing under rocks. 4–20 in. high, flowers pale mauve. Summer–Autumn. *A. Dieterlen*, 36!; south slopes of plateau, flowers bluish, *Phillips*, 910!; Natal, Van Reenen's Pass in rocky places, 5500 ft., March, flowers white and purple, *Wood*, 7187!

DISTRIBUTION: Graaff Reinet, Transvaal (Hooë Veld, Houtbosch, Daspoort, Johannesburg).

SESUTO: *Thōkōloane*. Meaning unknown. Given to children, in the form of a decoction, as a cure for colds.

MENTHA, *Linn.*

**M. longifolia**, Huds.; sub-species **polyadena**, Briq.

Damp spots in hollows on mountain slopes. 10–35 in. high, flowers mauve. Summer–Autumn. *A. Dieterlen*, 118!; Lefi's Kloof, flowers whitish, *Phillips*, 820!

DISTRIBUTION: Transvaal (near Pretoria).

SESUTO: *Koena*. A crocodile. An infusion is made with *Mentha longifolia*, sub-sp. *capensis*, and *M. aquatica*, and drunk as a cure for colds. These three plants are also put under the bedding of a patient suffering with a chest complaint, with the belief that they will make him breathe easier.

Sub-species **capensis**.

Damp spots on mountain slopes. 15-40 in. high, flowers a pale mauve. Summer-Autumn. *A. Dieterlen*, 214!; Witteberg Range, *Drège*, 4766A.

DISTRIBUTION: Namaqualand. Cape. Swellendam. Uitenhage. Albany. Queenstown. Ceres. Somerset East. Graaff Reinet. Griqualand West. East Griqualand.

SESUTO: *Koena ea thaba*. The crocodile of the mountain. See *M. longifolia*, sub-sp. *polyadena*.

**M. aquatica**, Linn.

Streams and damp spots on mountain slopes. 8-25 in. high, flowers pinkish-mauve. Summer, *A. Dieterlen*, 442!; ravine on west slopes of plateau, flowers pale blue, rare, *Phillips*, 585!, south slopes of plateau, flowers pink, *Phillips*, 872!; Natal, Mohlamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: Cape. Paarl. Knysna. Port Elizabeth. Queens-town. Komgha. Transkei. Tembuland. East Griqualand. Griqualand West. Orange Free State (without locality). Transvaal (Ermelo).

SESUTO: *Koena e nyenyane*. The small crocodile. *Koena ea liliba*. The crocodile of the springs. See *M. longifolia*, sub-sp. *polyadena*. The name "Koena" is given to the above species of *Mentha* because they grow in damp spots.

## SALVIA, Linn.

**S. clandestina**, Linn., var. *angustifolia*, Benth.

Veld at roadside between Berea and Maseru. 6-20 in. high. Autumn (March-April). *A. Dieterlen*, 979!

DISTRIBUTION: George. Somerset East. Graaff Reinet. Beaufort West. Fraserburg. Richmond. Middleburg. Griqualand West.

SESUTO: *Mosisili o likhatla*. The notched "Mosisili." Use unknown.

**S. triangularis**, Thunb.

Slopes of Malaoaneng and at Pitseng, Leribe District. 12-24 in. high, flowers mauve. Summer (November-February). *A. Dieterlen*, 957!, 1011!

DISTRIBUTION: Uitenhage. Stockenström. Somerset East.

SESUTO: *Mosisili*. Meaning and use unknown.

**S. stenophylla**, Burch.

Veld and mountain slopes. 8-15 in. high, flowers lilac, Spring-Autumn. *A. Dieterlen*, 196c!; very common, forms large patches, *Phillips*, 894!; Orange Free State, Wittebergen, *Bowker*, 658. Orange and Caledon Rivers, *Burke*, *Mrs. Hutton*; Harrismith, *Sankey*, 229.

DISTRIBUTION: Uitenhage. Fort Beaufort. Queenstown. Graaff Reinet. Beaufort West. Albert. Alice. Natal. Griqualand West. Bechuanaland. Orange Free State (Bethlehem). Transvaal (Potchefstroom, Warm Bath).

SESUTO: *Mosisili*. Meaning unknown. Mixed with tobacco to give it a flavour. The smoke is said to disinfect a hut where there has been sickness and to drive away bugs.

**S. runcinata**, Linn. f.

Veld and mountain slopes. 10-20 in. high, flowers lilac. Spring-Summer. *A. Dieterlen*, 196A!

DISTRIBUTION: Caledon. Riversdale. Uitenhage. Transkei. Griqualand West. Transvaal (Waterval Boven, Leeuwpot, Fourteen Streams).

SESUTO: *Mosisili*. Meaning unknown. See *S. stenophylla*.

**S. repens**, Burch.

Veld and mountain slopes. 10-20 in. high, flowers lilac. Spring-Summer. *A. Dieterlen*, 196B!; slopes of Malavaneng, Leribe District. 8-24 in. high, flowers white or mauve, January, *A. Dieterlen*, 956!, 958!, Potsane, Leribe District, *A. Dieterlen*, 923!; common in ravines and slopes round Leribe plateau, bush 1-2 ft., flowers blue or mauve, *Phillips*, 536! 576! 589! 615! 708! 818!

DISTRIBUTION: Alexandria. Albany. Somerset East. Graaff Reinet. Middleburg. Wodehouse. Albert.

SESUTO: *Mosisili*. Meaning unknown. *Mosisili oa loti* (923). "Mosisili" of the high mountains. See *S. stenophylla*.

**S. Cooperi**, Skan.

Bester's Vlei, near Witzie's Hoek, December, *Bolus*, 8237!

DISTRIBUTION: East Griqualand. Natal.

ACROTOME, *Benth.*

**A. inflata**, *Benth.*

Veld, roadside and cultivated lands. 12-30 in. high, flowers a very pale mauve. Summer-Autumn. *A. Dieterlen*, 89!; mountain slopes behind the Mission Station, a herbaceous plant, 12-18 in. high, flowers white, occasional, *Phillips*, 515!

DISTRIBUTION: Queenstown. Steynsburg. Albert. Bechuanaland. Orange Free State (Bloemfontein). Transvaal (Linokana, Nylstroom).

SESUTO: *Mohlayoane*. Meaning unknown. *Se-ea-le-moea*. It goes with the wind. (In winter the dry plant is easily uprooted and blown about by the wind.) Mixed with other plants it is given to cattle suffering from "black-leg."

#### STACHYS, *Linn.*

##### **S. grandifolia**, E. Mey.

Natal, Polela, April, *Fourcade* (*Wood*, 4556).

DISTRIBUTION: Swellendam. Queenstown. Somerset East. Graaff Reinet. Transkei. Transvaal (near Lydenburg).

##### **S. albiflora**, N. E. Br.

Natal, Drakensberg Range, 6-7000 ft., *Evans*, 395.

DISTRIBUTION: Endemic.

##### **S. Kuntzei**, Guerke.

Natal, Van Reenen's Pass, *Kuntze*; near Van Reenen in rocky places, 5800 ft., March, *Schlechter*, 6969!; De Beer's Pass, 5-600 ft., March, flowers white, pink-lined, *Wood*, 6029!

DISTRIBUTION: Orange Free State (without locality). Probably endemic.

##### **S. parilis**, N. E. Br.

Natal, Tiger Cave Valley on the Drakensberg Range, *Evans*, 387.

DISTRIBUTION: Endemic.

##### **S. aethiopica**, Linn., var. *glandulifera*, Skan.

Mountain slopes near rocks. 6-20 in. high, flowers mauve. Spring-Autumn. *A. Dieterlen*, 101!; common round Leribe plateau, usually growing in shade of rocks, leaves sticky, flowers mauve, pink, or pale blue, *Phillips*, 534! 829! 896!

DISTRIBUTION: Uitenhage. Cathcart. East London. Graaff Reinet. Middleburg. Komgha. Transkei. Natal. Orange Free State (Bethlehem).

SESUTO: *Bokhatla*. Meaning unknown. *Bolao ba litaōla*. The philtre of the divining bones. It is burnt in the hut of a person suffering with feverish delirium and is said to have a soothing effect.

##### **S. sessilis**, Guerke.

Basutoland, without precise locality, *Cooper*, 943.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Carolina District).



**S. obtusifolia**, MacOw., var. **angustifolia**, Skan.

Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8240 !, *Flanagan*, 1898 !

DISTRIBUTION: Endemic.

**S. rugosa**, Ait. var. **linearis**, Skan.

Mountain slopes. 12-26 in. high, flowers pink. Summer. Sehonghong, on the Drakensberg. *A. Dieterlen*, 747 !

DISTRIBUTION: Clanwilliam. Albany. Calvinia. Somerset East. Cradock. Graaff Reinet. Murraysburg. Sutherland. Middleburg. Colesberg.

SESUTO: *Taraputsōe*. Meaning unknown. Used to brew a kind of tea.

**S. dregeana**, Benth.

Mont-aux-Sources, 8000 ft., December, *Flanagan in Herb. Bolus*, 8241 !; Wittebergen, 7-8000 ft., *Drège*.

DISTRIBUTION: Tarka. Cradock. Albert.

var. **lasiocalyx**, Skan.

High mountain slopes at Lehonghong, 8-15 in. high, flowers mauve. Summer-Autumn, *A. Dieterlen*, 905 !; grassy slopes of the Mont-aux-Sources, 8500 ft., January, flowers pink, *Thode*, 46 !

DISTRIBUTION: Endemic.

SESUTO: *Selaoane se seholo*. The big "Selaoane." Use unknown.

var. **tenuior**, Skan.

Ben McDhui, 9200 ft., March, flowers purple, *Galpin*, 6817 !

DISTRIBUTION: Endemic.

**S. hyssopoides**, Burch.

Veld and roadsides. 5-20 in. high, flowers pinkish-mauve. Spring-Autumn. *A. Dieterlen*, 287 !; Bester's Vlei, near Witzie's Hoek, December, *Bolus*, 8239 !; Wolve Kop, *Burke*, 392; Wittebergen, *Drège*, 3588a.

DISTRIBUTION: Uitenhage. Queenstown. Cathcart. Stockenstroom. Tarka. Graaff Reinet. Murraysburg. Victoria West. Middleburg. Albert. Transkei. Natal. Griqualand West. Bechuanaland. Transvaal (Magaliesberg, Standerton, Vereeniging).

SESUTO: *Selaoane*. Meaning unknown. *Motlapa tsūnyana*. Meaning unknown.

**S. caffra**, E. Mey.

Natal, Oliver's Hoek Pass, *Wood*, 3491; Van Reenen, 5500 ft., *Wood*, 5195.

DISTRIBUTION: King William's Town. Komgha. Transkei. Pondoland. East Griqualand. Orange Free State (without locality). Transvaal (Pretoria).

LEONOTIS, *R. Br.***L. mollis**, Benth. (ex descr.).

Mountain slopes, 1-4 ft. high, flowers reddish-brown. Autumn. *A. Dieterlen*, 106!; mountain slopes behind Mission Station, growing next to a rock, bush, 4-6 ft., flowers red, occasional, *Phillips*, 519a!

DISTRIBUTION: Uitenhage. Albany. Queenstown. Somerset East. Graaff Reinet. Beaufort West. Philipstown. Orange Free State (Sand Drift).

SESUTO: *Joala ba linonyana*. The beer of the birds. (Birds visit the flowers for the sake of the nectar). Mixed with tobacco; also used as a purgative.

**L. latifolia**, Guerke.

Natal, Van Reenen's Pass, 5500-6200 ft., *Kuntze*.

DISTRIBUTION: Natal.

**L. dysophylla**, Benth.

Natal, between the Tugela and Klip Rivers, *Gerrard*, 393; Drakensberg, near Ladysmith, *Wilms*, 2111.

DISTRIBUTION: Transkei. East Griqualand. Orange Free State (without locality). Transvaal (Rooiplaat, near Heidelberg, near Lydenburg).

AJUGA, *Linn.***A. Ophrydis**, Burch.

Veld and mountain slopes. 4-16 in. high, flowers mauve. Spring-Summer. *A. Dieterlen*, 53!; Basutoland, Drakensberg, 8000 ft., *Mellish*, without locality, *Cooper*, 290!; Wittebergen, *Mrs. Barber* and *Mrs. Bowker*; Wolve Kop, *Burke*; Harrismith, *Sankey*, 227.

DISTRIBUTION: Uitenhage. Bathurst. Albany. Fort Beaufort. Stockenström. Cathcart. Somerset East. Komgha. Transkei. Tembuland. East Griqualand. Natal, Transvaal (Heidelberg, near Lydenburg, Vereeniging).

SESUTO: *Senyarela*. He who looks in from above. Used as a medicine in cases of painful menstruation.

NYCTAGINEAE.

BOERHAAVIA, *Vaill.*

**B. pentandra**, Burch.

Caledon River, January, *Zeyher*, 1433!, *Burke*.

DISTRIBUTION: S.W. Africa. Griqualand West. Bechuanaland. Transvaal (near Louw's Creek, Barberton). Natal.

ILLECEBRACEAE.

POLLICHIA, *Sol.*

**P. campestris**, Soland.

Mountain slopes. 3-20 in. high, flowers whitish. Summer. *A. Dieterlen*, 7!; near stream on Leribe plateau, in damp ground, *Phillips*, 809!; Basutoland, without precise locality, *Cooper*, 2488 bis.

DISTRIBUTION: Uitenhage. Port Elizabeth. Albany. Queenstown. Albert. East Griqualand. Natal. Transvaal (Valkfontein, Waterval Boven, Lydenburg, near Potschefstroom, Hooge Veld, Bosch Veld):

SESUTO: *Letsoai*. Salt. *Sefakoana*. Small hail-stones. *Mono-kotsoai oa makhoaba*. The mulberry of the rooks. Children eat the small white fruits of the plant.

HERNIARIA, *Linn*

**H. hirsuta**, Linn.

Veld and mountain slopes. 2-6 in. high, flowers greenish white. Summer. *A. Dieterlen*, 152!; Thaba Unchu, *Burke*.

DISTRIBUTION: Cape. Bredasdorp. Aliwal North. Somerset East. Graaff Reinet. Griqualand West. Transvaal (near Johannesburg).

SESUTO: *Tlōkōfiloane ea lekooba*. The overpowering froth of foam. As a decoction, it is taken as a cure for sore throat.

AMARANTACEAE.

AMARANTHUS, *Linn.*

**A. paniculatus**, Linn.

In cultivated lands. 6-35 in. high, flowers greenish-white. Summer. *A. Dieterlen*, 162!; a herbaceous plant 1-2 ft. high, occasional, *Phillips*, 516!

DISTRIBUTION: Queenstown. Natal. Transvaal (near Lydenburg, Standerton).

SESUTO: *Theepe ea Bokoni*. The "Theepe" of Kaffraria. A weed introduced into Basutoland by cattle from the Cape Province. When quite young it is used as a spinach.

**A. Thunbergii**, Moq.

Mountain slopes and in cultivated lands. 6-30 in. high, flowers greenish-white. Summer. *A. Dieterlen*, 524!; Matsoberane, Leribe District. Autumn (April). *A. Dieterlen*, 995!; Basutoland, without precise locality, *Cooper*, 3049, 3500.

DISTRIBUTION: Cape. Uitenhage. Queenstown. Graaff Reinet. Richmond. Albert. Natal. Bechuanaland. Transvaal (Marico District, Potchefstroom, Springbok Flats, near Standerton).

SESUTO: *Theepe*. Meaning unknown. Eaten as a vegetable when young.

CYATHULA, *Lour.*

**C. cylindrica**, Moq.

Stony spots on mountain slopes. 12-36 in. high, flowers whitish. Summer. *A. Dieterlen*, 467!; Natal, Van Reenen, 5-6000 ft., *Wood*, 5703.

DISTRIBUTION: Pondoland. Natal. Orange Free State (without locality). Transvaal (near Aapie's River).

SESUTO: *Bohōme bo boholo*. The big "Bohōme." Derived from verb "ho homa"—to stick to. The roots are used as soap.

**C. globulifera**, Moq.

Mountain slopes and round kraals. 12-40 in. high, flowers whitish. Summer. *A. Dieterlen*, 87!; ravine on west slopes of plateau, rare, *Phillips*, 725!, south slopes of plateau, flowers white, *Phillips*, 891!

DISTRIBUTION: Albany. Queenstown. Graaff Reinet. Aliwal North. Komgha. Pondoland. East Griqualand. Natal. Orange Free State (Bloemfontein, Sand Drift Pont). Transvaal (near Lydenburg, near Pretoria).

SESUTO: *Bohōme bo boholo*. See *C. cylindrica*.

ACHYRANTHES, *Linn.*

**A. aspera**, Linn.

Mountain slopes near or under rocks. 5-20 in. high, flowers mauve. Spring-Summer. *A. Dieterlen*, 41!, on the slopes of Makhoarane Mountain, Leribe District, 20-35 in. high, flowers purplish-brown. Autumn (April). *A. Dieterlen*, 986!; N.E. slopes of plateau, frequent, *Phillips*, 846!; Natal, De Beer's Pass, 5-6000 ft., March, flowers pink, *Wood*, 6020!

**DISTRIBUTION:** Cape. Uitenhage. Somerset East. Komgha. East Griqualand. Natal. Griqualand West. Orange Free State (Modder River Drift, Vet River). Transvaal (near Lydenburg, Pretoria, Rooiplaat, near Barberton, Potgieter's Rust).

**SESUTO:** *Bohōme bo bolelele* (986). The tall "Bohōme." *Mokhoatha-Khoale* (986). He who pokes the partridges. *Lenamo* (41). He who spreads. *Bohōmane* (41). The small "Bohōme." *Dieterlen* (41) is a small-leaf form, with the leaves densely pubescent beneath.

#### ALTERNANTHERA, Forsk.

##### A. Achyrantha, R. Br.

Garden of the Residency at Maseru. A creeping plant 4-12 in. long, flowers whitish. Autumn (April). *A. Dieterlen*, 982!

**DISTRIBUTION:** Queenstown. Alice. Pondoland. Griqualand West. Transvaal (Daspoot).

**SESUTO:** *Bohōme bo namang*. The creeping "Bohōme." Use unknown.

#### CHENOPODIACEAE.

##### CHENOPODIUM, Linn.

##### C. ambrosioides, Linn.

Veld, road-sides, and round villages. 20-50 in. high, flowers cream. Summer. *A. Dieterlen*, 409!

**DISTRIBUTION:** Cape. Uitenhage. Albany. Queenstown. Komgha. Natal. Transvaal (Pretoria).

**SESUTO:** *Setla-bocha*. The new-comer. *Setlana se habea*. The plant has fits. *Mokhankha*. He who smells. *Pōea e kholo*. The big "Pōea." Derived from the verb "ho boea"—to return (the plant appears each season at the same place). A weed introduced into Basutoland.

##### C. murale, Linn.

Shady spots on mountain slopes. 6-25 in. high, flowers greenish-yellow. Winter (June). *A. Dieterlen*, 824!

**DISTRIBUTION:** Cape. Uitenhage. Albany. Murraysburg. Natal. Transvaal (Pretoria, near Lydenburg).

**SESUTO:** *Thumana* or *Thumane*. Meaning and use unknown.

##### C. album, Linn.

Veld and in cultivated lands. 10-50 in. high, flowers green. Summer. *A. Dieterlen*, 77!



DISTRIBUTION: Cape. Beaufort West. Murraysburg. Richmond. Graaff Reinet. Komgha. Transvaal (Standerton, Warm Bath).

SESUTO: *Serue*. *Pagekoane*. Meanings unknown. The young plant is used as a vegetable. Madame Dieterlen states that the disagreeable smell of the fresh plant disappears on cooking, and that it makes a very pleasant dish.

**C. foetidum**, Schrad.

Veld and cultivated lands. 5-35 in. high, flowers green. Summer-Autumn. *A. Dieterlen*, 22!; Qoqolosi Peak, flowers greenish, *Phillips*, 936!

DISTRIBUTION: An introduced weed.

SESUTO: *Mokhankla*. He who smells. Use unknown.

ROUBIEVA, *Moq.*

**R. multifida**, Moq.

Veld and mountain slopes. 5-20 in. high, flowers whitish. Summer. *A. Dieterlen*, 664!

DISTRIBUTION: Cape. Albany. Transvaal (Standerton).

SESUTO: *Sella boeha*. The new-comer. *Mokhankla*. He who smells. Use unknown.

PHYTOLACCACEAE. .

PHYTOLACCA, *Linn.*

**P. heptandra**, Retz.

Dongas and mountain slopes. 6-25 in. high, flowers reddish-yellow. Spring-Summer. *A. Dieterlen*, 48a! 48b!; south slopes of Leribe plateau above Khaniane near rocks, fruits red and fleshy, *Phillips*, 904!; Harrismith, *Sankey*, 239; Aliwal North, bank of Orange River, *Burke*.

DISTRIBUTION: Fort Beaufort. Queenstown. Graaff Reinet. Albert. Transkei. East Griqualand. Natal. Transvaal (Aapie's River, near Lydenburg).

SESUTO: *Monatja* and *Monatsoana*. Both words mean "a small pleasant taste (of food)." Some natives say that the fruits may be eaten and have rather a pleasant taste, but that the root is poisonous; Madame Dieterlen remarks on the fact that everything in the plant "line" which is edible is eagerly sought for by the natives, so much so that some species, e.g. *Schizoglossum* spp., have become very rare even within her own recollection, yet the above plant, which is plentiful round some parts of Leribe slopes, may always be found in fruit, showing that the natives do not eat them.

POLYGONACEAE.

POLYGONUM, *Linn.*

**P. aviculare**, *Linn.*

Damp spots on veld and mountain slopes, also round Hlotse pond. A creeping plant, 10–30 in. long, flowers white, pale pink, or crimson. Summer–Autumn (November–April). *A. Dieterlen*, 23a, b, c!; Basutoland, without precise locality, *Cooper*, 3057; Natal, Van Reenen's Pass, 5000 ft., *Wood*, 4564.

DISTRIBUTION: Namaqualand Minor. Cape. Riversdale. Queens-town. Victoria West. Albert. Komgha. East Griqualand. Griqualand West. Transvaal (Pretoria, Zeerust, Heidelberg, Potchefstroom).

SESUTO: *Moraran 'a nōkana*. The creeper of the small river. *Moraran 'a letsāna*. The creeper of the small lake. Use unknown.

**P. amphibium**, *Linn.*

Water courses. A floating plant, 10–40 in. long, flowers pink. Spring. *A. Dieterlen*, 814!

DISTRIBUTION: Somerset East. Orange Free State (Sand River, Vredefort). Bechuanaland. Transvaal (Standerton, Klerksdorp).

SESUTO: *Sesesi se seholo*. The large swimmer. Use unknown.

**P. serrulatum**, *Lag.*

Water-courses and damp spots. 8–20 in. high, flowers pink. Summer–Autumn. *A. Dieterlen*, 563!; near stream at base of ravine on west slopes of Leribe plateau, *Phillips*, 627!; Natal, Polela, *Fourcade in Herb. Wood*, 4238; Drakensberg, *Rehmann*, 7021.

DISTRIBUTION: Cape. Caledon. Uitenhage. Somerset East. Transkei. Natal. Orange Free State (Parys), Transvaal (Barberton, Mac Mac, Leydenburg, Komati Poort, Pretoria).

SESUTO: *Tolo la Khongona le lenyenyane*. The small knee of the young cattle.

**P. lapathifolium** sub-sp. *maculatum*, *Dyer and Trin.*

Damp places. 30–48 in. high, flowers pink. Summer–Autumn. *A. Dieterlen*, 109!; banks of streams on Leribe plateau, flowers red, *Phillips*, 702!; Harrismith, *Sankey*, 252.

DISTRIBUTION: Cape. Uitenhage. Graaff Reinet. Transkei. Natal. Griqualand West. Transvaal (Standerton, Lydenburg, Pretoria, Aapie's River, Potchefstroom, Springbok flats).

SESUTO: *Tolo la Khongoana*. The knee of young cattle. Use unknown.

## RUMEX, Linn.

**R. nepalensis**, Spreng.

Damp spots on mountain slopes. 20–49 in. high, flowers green. Summer. *A. Dieterlen*, 382!; Basutoland. without precise locality, *Cooper*, 2986; Harrismith, *Sankey*, 253; swamps on the Drakensberg, *Evans*, 383; Kraai River, 4500 ft., *Drège*.

DISTRIBUTION: Graaff Reinet. Transkei. Transvaal (Fountain Grove).

SESUTO: *Khamanee kholo*. The large “Khamane.” *Pota ka leleme*. Going round with the tongue. *Molōkōle*. Meaning unknown. A medicine for newly confined women is prepared from it.

**R. sagittatus**, Thunb.

Mountain slopes. 10–30 in. high, flowers green. Summer. *A. Dieterlen*, 39!; Harrismith, *Sankey*, 251.

DISTRIBUTION: George. Uitenhage. Port Elizabeth. Albany. Somerset East. Graaff Reinet. Pondoland. Natal. Swaziland. Transvaal (near Lydenburg, Valkfontein, Sabie, Pretoria).

SESUTO: *Bolila bo boholo*. The large sorrel (or sourness). Use unknown.

**R. Acetosella**, Linn.

Damp spots. 5–16 in. high, flowers yellowish. Spring–Summer. *A. Dieterlen*, 740! 762!

DISTRIBUTION: Cape. Humansdorp. Tembuland. Natal. Transvaal (Johannesburg, Pretoria).

SESUTO: *Bolilanyana*. The small sorrel (or sourness). Use unknown.

**R. Meyeri**, Meisn.

Aliwal North, Kraai River, 4500 ft., *Drège*.

DISTRIBUTION: Beaufort West. Middleburg.

**R. ecklonianus**, Meisn.

Damp and shady spots. 5–22 in. high, flowers green. Summer. *A. Dieterlen*, 111!; Lefi's Kloof, N.E. slopes of Leribe plateau, damp ground, flowers yellow, *Phillips*, 807!, south slopes of Leribe plateau above Khaniane, flowers greenish-yellow, *Phillips*, 893!

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Cape. Riversdale. Uitenhage. Albany. Graaff Reinet. Colesberg. Tembuland. East Griqualand. Natal. Griqualand West. Transvaal.

SESUTO: *Khamane*. Meaning unknown. A hot decoction prepared with this plant is used for washing wounds and bruises.

**R. Woodii**, N.E. Br.

In shade under rocks on mountain slopes. 7-30 in. high, flowers yellowish. Summer. *A. Dieterlen*, 466!

DISTRIBUTION: Somerset East. Komgha. Natal. Orange Free State (Bethlehem). Transvaal (Carolina, Ermelo, Lydenburg).

SESUTO: *Bolila ba likhomo*. The sorrel (or sourness) of cattle. The shepherd boys eat this plant raw. A medicine is prepared from it and given to calves suffering with diarrhoea.

PIPERACEAE.

PEPEROMIA, *Ruiz. and Pav.*

**P. retusa**, A. Dietr.

Natal, Van Reenen, 7500 ft., March, *Schlechter*, 6995!

DISTRIBUTION: Cape. Riversdale. Swellendam. Somerset East. Komgha.

PROTEACEAE.

PROTEA, *Linn.*

**P. Rouppelliae**, Meisn.

Maluti Mountains, Mafube on East Griqualand borders. Bracts red. February. *A. Dieterlen*, 946!; Bester's Vlei, near Witzie's Hoek, 5600 ft., December, *Flanagan*, 1849!; *Bolus*, 8242!; Nelson's Kop, *Cooper*, 952!; Natal, Van Reenen's Pass, *Krook*, 1586!; *Wood*, 5632!; slopes of the Drakensbergen, near Tugela Falls, *Wood*, 3514!; Pot River Berg, 5700 ft., March, *Galpin*, 6822!

DISTRIBUTION: Pondoland. Transvaal (near Johannesburg, Houtbosch, Barberton, Magaliesberg, Lydenburg). Swaziland.

SESUTO: *Seqalaba*. Meaning unknown. Used for fuel.

**P. subvestita**, N.E. Br.

Maluti Mountains, near Qacka's Nek, on the border between Basutoland and East Griqualand. Autumn (March), bracts pale-pink. *A. Dieterlen*, 993!; Natal, Van Reenen, *Wood*, 5631!; mountain side, Trent Kop, 5900 ft., March, a shrub 8 ft. high, bracts white or pink, *Galpin*, 6824!; summit Omapua Mountain, *Thode*, 47!

DISTRIBUTION: Pondoland.

SESUTO: *Seqalaba se sesoen*. The white (or light-coloured) "Seqalaba." Used for fuel.

**P. caffra**, Meisn.

Lefi's Nek Kloof. Bracts pink and cream. Spring (September-March). *A. Dieterlen*, 319!; Lefi's Kloof, *Phillips*!

DISTRIBUTION: Transvaal (Magaliesberg, Heidelberg, Zeerust, Rustenburg).

SESUTO: *Sekila*. Like a fowl's kidney. Used for fuel. This Protea is only found in one of the many ravines round the Leribe plateau; it does not extend far into the ravine, but grows on the exposed grass slopes. It is a tree with the habit of *P. grandiflora*, Thunb., and from a distance could easily be mistaken for that species. Unfortunately it is rapidly becoming exterminated, as the chief Jonathan now and then has trees cut down for firewood; but fortunately this is a privilege Jonathan alone enjoys, otherwise the species would long ago have disappeared from the neighbourhood.

*P. multibracteata*, Phillips.

On the Drakensbergen, *Cooper*, 951!

DISTRIBUTION: King William's Town. Transkei. Tembuland. Natal.

*P. simplex*, Phillips.

Pot River Berg, 5700 ft., March, *Galpin*, 6823!

DISTRIBUTION: Tembuland. Natal. Swaziland.

## THYMELAEACEAE.\*

### PASSERINA, *Linn.*

*P. ericoides*, *Linn.*

Mountain slopes. A bush, flowers pink. Autumn. *A. Dieterlen*, 49!; Natal, near Hoffenthal, 4-5000 ft., *Wood*, 3464.

DISTRIBUTION: Cape. Ceres. Riversdale. Swellendam. Mossel Bay. Uitenhage. Port Elizabeth. Albany. Bathurst. Somerset East. Molteno. Albert. Orange Free State (without locality). Transvaal (Mac Mac). Natal.

SESUTO: *Lekhapu*. Meaning unknown. Used for fuel.

*P. sp.*

Natal, Bushman's Pass, Drakensberg. November, *Thode*.

### STRUTHIOLA, *Linn.*

*S. sp.* (near *S. parviflora*, Bartl.).

Natal, Mont-aux-Sources (*ex Wood's Natal List*).

\* As this was in the printer's hands before the publication of Mr. Wright's monograph in the 'Flora Capensis,' some alterations will have to be made to the naming and geography.



GNIDIA, Linn.

**G. phaeotricha**, Gilg. (*ex* Wood's Natal List).

Natal, Van Reenen, 5-6000 ft. *O.*, Kuntze.

LASIOSIPHON, Fresen.

**L. caffer**, Meisn.

Natal, near Hoffenthal, 4-5000 ft., (no collector given).

**L. Meisnerianus**, Endl. var.

Natal, Van Reenen, 5-6000 ft., *Wood*, 4520.

**L. Kraussii**, Meisn.

Veld and mountain slopes, flowers yellow. Spring. *A. Dieterlen*, 178!; Mont-aux-Sources, 9500 ft., October, *A. Bolus in Herb. Guthrie*, 4905!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8246!

DISTRIBUTION: Natal.

SESUTO: *Thōpa*. To oppress. Used as a decoction to bathe wounds and bruises. It is said to be poisonous.

**L. anthylloides**, Meisn.

Mountain slopes. A shrub, 3-5 ft. high, flowers yellow, strongly scented. Winter-Spring. *A. Dieterlen*, 121!

DISTRIBUTION: Riversdale. George. Albany. Transkei. Tembuland. Natal. Zululand. Transvaal (Pretoria, Carolina).

SESUTO: *Moomang*. Derived from the verb "ho omana"—to quarrel. Used for fuel only when nothing else is available, as the natives believe that the smoke bewitches people and makes them quarrelsome, and that the inmates of the hut in which the plant was burnt will eventually quarrel.

**L. linifolius**, Dcne.

Veld and mountain slopes. 8-20 in. high, flowers light brown. Spring. *A. Dieterlen*, 371!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8245!

DISTRIBUTION: Somerset East. East Griqualand. Bechuanaland. Transvaal (Houtbosch, Barberton).

SESUTO: *Thōpa e nyenyane*. The small "Thōpa." *Setele*. Meaning unknown. Used as a snuff to cure headaches. It is said to be non-poisonous.

## ARTHROSOLEN, C. A. Meyer.

**A. gymnostachys**, C. A. Mey.

River banks and mountain slopes. 4-20 in. high, flowers reddish-brown. Summer. *A. Dieterlen*, 422!

DISTRIBUTION: Natal (South Downs, Weenen County 4-5000 ft.).

SESUTO: *Thōpananyana*. The small "Thōpa." *Tsika-mangotsoana*. Around the small dongas. The leaves are smoked to relieve headaches.

## SANTALACEAE.\*

THESIUM, *Linn.***T. sp.**

Stony spots on veld. 8-16 in. high, flowers white. Spring. *A. Dieterlen*, 620!

SESUTO: *Motayoane*. Meaning and use unknown.

**T. sp.**

Mountain slopes, Malavaneng, Leribe district. Flowers whitish. Summer (December). *A. Dieterlen*, 953!

SESUTO: *Marakalle*. Derived from the verb "ho rakalla"—to stand with outstretched legs. Used as a medicine for colds on the chest.

**T. sp.**

Veld and mountain slopes. 2-10 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 647b!

SESUTO: *Bohoho*. Meaning unknown. *Sebitsane*. The small "Sebitsa." Used for chest colds.

**T. sp.**

Veld and mountain slopes.  $1\frac{1}{2}$ -3 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 647a!

SESUTO: *Bohoho*. *Sebitsane*. See above species.

**T. sp.**

Veld and mountain slopes. 8-18 in. high, flowers white. Spring-Summer. *A. Dieterlen*, 462b!

SESUTO: *Marakalle*. See *A. Dieterlen* No. 953 above. *Lisin-li-lale*. Let the big grain baskets ("Lisin") remain empty.

\* As this Order will soon appear in the 'Flora Capensis,' I thought it advisable to defer naming the species until the 'Flora' is published.

**T. sp.** (cf. *T. angulosum*, DC.).

Mountain slopes. 8–18 in. high, flowers white. Summer–Autumn. *A. Dieterlen*, 462a !

SESUTO: *Marakalle*. See *A. Dieterlen* No. 953 above. *Lisin-li-lale*. See *A. Dieterlen* No. 462b above. Used in cases of heart-burn.

**T. sp.**

Mountain slopes. 4–15 in. high, flowers white. Spring. *A. Dieterlen*, 735 !

SESUTO: *Marakalle a manyenyane*. The small “Marakalle.” Used for chest colds.

COLPOON, *Berg.*

**C. compressum**, *Berg.*

Ravines and mountain slopes. A tree, flowers yellow. Spring. *A. Dieterlen*, 248 !

DISTRIBUTION: Cape. Riversdale. Uitenhage. Port Elizabeth. Komgha. Natal.

SESUTO: *Mofetōla*. He who causes to change. Used for tanning skins. Pointed sticks are made from the branches and used for stirring meat in the cooking-pots.

EUPHORBIACEAE.

EUPHORBIA, *Linn.*

**E. basutica**, *Marl.*

Mountain slopes. Flowers yellow. Summer. Lihlatsoaneng, Leribe District, *A. Dieterlen*, 415 !

DISTRIBUTION: Endemic.

SESUTO: *Sehlōkō*. Meaning unknown. A lotion is prepared from this to bathe swollen feet. Together with *Berkheya onopordifolia*, it is used as a cure for leprosy. At present there is a native at the Leper Settlement, Maseru, who pretends to cure leprosy by means of these plants.

**E. striata**, *Thunb.*

Veld and mountain slopes. 15–35 in. high, flowers green and yellow. Spring–Autumn. *A. Dieterlen*, 351 !

DISTRIBUTION: Komgha. East Griqualand. Transvaal (Magaliesberg.)

SESUTO: *Mohlatsisa*. He who procures vomiting. *Matsoane*. The small black things. Put in sour milk to give it a pleasant taste.

**E. Peplus**, Linn.

Shady spots on mountain slopes. 5-12 in. high, flowers yellowish. Autumn. *A. Dieterlen*, 588!

DISTRIBUTION: Cape. Komgha.

SESUTO: *Lefōkōtsane le lenyenyane*. The small feeble one. Use unknown.

**E. sanguinea**, Hochst and Steud.

Ravines and mountain slopes. Flowers yellowish. Summer (February). *A. Dieterlen*, 960a! 960b!; garden of the residency at Maseru and veld at Tlapaneng, flowers yellowish. Autumn (April). *A. Dieterlen*, 981!; veld, near a donga on the road from Maseru to Berea, flowers yellowish. Autumn (April). *A. Dieterlen*, 988!

DISTRIBUTION: Natal. Griqualand West. Orange Free State (Bethulie).

SESUTO: *Seloe*. Do not fight. *Khama-masoana*. Strangle the young bachelors. *Tatampoi e nyenyane*. Meaning unknown. A medicine for sore breasts in sucking mothers is prepared from it.

**E. sp.**

Mountain slopes at Malavaneng, Leribe District. 10-30 in. high, flowers yellowish. Summer (January). *A. Dieterlen*, 675a!

SESUTO: *Sehlakoana se senyenyane*. The small "Sehlakoana." Use unknown.

## PHYLLANTHUS, Linn.

**P. Woodii**, Hutch.

Under rocks and on the banks of streams.  $2\frac{1}{2}$ -18 in. high, flowers yellowish. Summer. *A. Dieterlen*, 537!

DISTRIBUTION: Natal.

SESUTO: *Seloe*. Do not fight. See note under *Euphorbia sanguinea*.

**P. sp.**

Mountain slopes. 6-15 in. in. high, flowers yellowish. Summer. *A. Dieterlen*, 675b!

SESUTO: *Sehlakoana se senyenyane*. The small "Sehlakoana." Use unknown.

## CLUYTIA, Linn

**C. natalensis**, Bernh.

Banks of streams.  $1-4\frac{1}{2}$  ft. high, flowers cream. Autumn. *A. Dieterlen*, 321!; bush in ravines and near water at the entrance of the

ravines, flowers greenish, *Phillips*, 582! 622! 637!; Caledon River, *Zeyher*, 1512!

DISTRIBUTION: Queenstown. East Griqualand. Natal.

SESUTO: *Mosali e mofubelu*. The red woman (so-called because the stems of the adult plant have a reddish colour). Used to make the enclosures ("liotloana") surrounding the native huts.

**C. pulchella**, Linn.

Ravine and mountain slopes. Bush, flowers cream. Spring-Summer. *A. Dieterlen*, 258!; bush, 3-4 ft. high; in ravine, *Phillips*, 577!

DISTRIBUTION: Cape.

SESUTO: *Mohlatsoa-mafi*. He who washes thick milk. Used for fuel.

**\*C. hirsuta**, E. Mey.

Bester's Vlei, near Witzie's Hoek, 5600 ft., December, *Bolus*, 8250!

DISTRIBUTION: Natal.

**\*C. nana**, Prain.

Mont-aux-Sources, c. 9300 ft., October. *Mann in Herb. Marloth*, 2870!

DISTRIBUTION: Endemic.

**\*C. alpina**, Prain.

Wittebergen, Ben McDhui, c. 9300 ft., March, *Galpin*, 6827!

DISTRIBUTION: Endemic.

ACALYPHA, Linn.

**\*A. punctata**, Meisn.

Bester's Vlei, near Witzie's Hoek, 5700 ft., December, *Bolus*, 8251!

URTICACEAE.

CELTIS, Linn.

**C. Kraussiana**, Bernh.

Dry spots on mountain slopes. A tree, flowers cream. Spring. *A. Dieterlen*, 193!

DISTRIBUTION: Komgha. Transkei. Natal.

SESUTO: *Molutu*. Meaning unknown. *Mohat'l'a-Khomo*. An ox tail. Used for making strong sticks, building huts, and also as fuel.

\* These four species were added after I had completed my table showing the systematic constituents of the Eastern Mountain Region flora.



CANNABIS, *Linn.***C. sativa**, *Linn.*

Veld and cultivated. 2-5 ft. high, flowers yellow. Autumn. *A. Dieterlen*, 115!

DISTRIBUTION: Albany. Komgha. Natal.

SESUTO: *Matakoane*. *Matokoane*. *Matekoane*. Meaning unknown. These are all forms of the same word. 'Moana. Meaning unknown. Smoked by many of the natives. The seeds are ground and mixed with bread or "pap" and given to a child which is being weaned.

URTICA, *Linn.***U. dioica**, *Linn.* var. **eckloniana**.

Mountain slopes. Flowers cream. Autumn. *A. Dieterlen*, 59b!; Caledon River, *Burke*, 306!

DISTRIBUTION: Endemic.

SESUTO: *Bobatsi*. Meaning unknown. A cure for snake-bite is prepared from this and other plants.

**U. Meyeri**, *Wedd.*, var. **lobulata**.

Stony spots on mountain slopes. Flowers cream. Summer. *A. Dieterlen*, 59a!

DISTRIBUTION: Graaff Reinet. Molteno.

SESUTO: *Bobatsi*. See under *U. dioica* var. *eckloniana*.

## MYRICACEAE.

MYRICA, *Linn.***M. aethiopica**, *Linn.*

Mountain slopes. A bush, flowers yellowish. Summer. *A. Dieterlen*, 561!

DISTRIBUTION: Cape. Natal.

SESUTO: *Monna e motsō*. The black man. *Malōleka*. *Malōleha*. Meanings unknown. A medicine given in cases of painful menstruation is prepared from it. Also used for fuel.

## SALICINEAE.

SALIX, *Linn.***S. capensis**, *Thunb.*

Streams in Kloof. A tree, flowers white. Summer. *A. Dieterlen*, 314a!

DISTRIBUTION: Namaqualand Minor. Worcester. Ceres. East Griqualand. Griqualand West. Transvaal (Barberton).

SESUTO: *Moluoane*. Meaning unknown. A preparation for use in burns is made from it. The "Lefèhlo," a stick used in starting a fire by friction, is made from the branches. Also used for fuel.

**S. Woodii**, Seem.

Caledon River at Metlotloaneng. Flowers white. Summer. *A. Dieterlen*, 314b!; a small overhanging tree on the banks of the Caledon River, *Phillips*!; Orange Free State, Albertina, 5-6000 ft., February, flowers white, *Wood*, 9769!

DISTRIBUTION: Natal.

SESUTO: *Moluoane*. Meaning unknown. See notes under *S. capensis*.

## MONOCOTYLEDONS.

### HYDROCHARIDEAE.

#### LAGAROSIPHON, *Harv.*

**L. cf. L. muscoides**, *Harv.*

River Hlotsi, Makokoane, Leribe District. November. *A. Dieterlen*, 1031!

SESUTO: *Joang ba metsi*. The grass of the water. The specimen is without flowers or fruit.

### ORCHIDEAE.

#### EULOPHIA, *R. Br.*

**E. flaccida**, Schltr.

Mountain slopes. 10-18 in. high, flowers yellow and green. Summer. *A. Dieterlen*, 405b!

DISTRIBUTION: Komgha. Natal.

SESUTO: *Lekoeshá*. The astrigent one (a reference to the astrigent nature of the tubers). *Lekhōlela*. That which grows of itself (referring to the fact that the plant propagates itself vegetatively by means of the underground tubers). Another meaning of the same word is: "He who tears or snatches away (the disease)." The burnt tubers are crushed and the powder placed in incisions made on sore limbs. The natives say the medicine snatches away the pain. Among the *Orchideae* the natives only employ species of *Eulophia* medicinally, as indicated above. See also under *E. hians*.

**E. aemula**, Schltr.

Caledon River, *Burke*; Harrismith, *Sankey*, 257; Eland's River Valley, near the Mont-aux-Sources, 6000 ft., January, *Flanagan*, 1984!

DISTRIBUTION: Komgha. Transkei. Tembuland. Natal. Transvaal (Magaliesberg, Barberton, Lydenburg, Pretoria, Heidelberg).

**E. Flanaganii**, Bolus.

Methotloaneng, on the banks of the Caledon. 12-20 in. high, flowers lilac. Spring. *A. Dieterlen*, 861!

DISTRIBUTION: Queenstown. Aliwal North. Komgha.

SESUTO: *Lekhōlela*. See *E. flaccida*. 'Mametsana. The mother of the little water. This is an allusion to the watery nature of the tubers. The native children eat the tubers freely, so much so, that orchids are becoming rare in Basutoland.

**E. hians**, Spreng.

Veld and mountain slopes. 12-18 in. high, flowers dark violet. Spring. *A. Dieterlen*, 291!

DISTRIBUTION: Cape. George. Bathurst. Albany. Bedford. Fort Beaufort. Stockenstrom. Queenstown. Cathcart. Komgha. Transkei. Tembuland. East Griqualand. Natal. Orange Free State (Bethlehem). Transvaal (various localities).

SESUTO: *Mahōlahanya*. Those arising in succession adhering one with another. (An allusion to the manner in which the tubers are formed). *Moisatōlea*. He who goes far. (An allusion to growth of the plant). *Rètè la ntja*. The testicle of a dog. *Lekhōlela*. See *E. flaccida*. The tubers of this plant or *E. hians* (or both) are placed in a clay pot filled with water. This water is drunk daily by barren women (the pot being kept full by the addition of fresh supplies) for four months, after which they become pregnant.

**E. robusta**, Rolfe.

Mountain slopes and plateau. 12-18 in. high. flowers pale mauve and violet. Spring. *A. Dieterlen*, 134!; Natal, Oliver's Hoek, sources of the Tugela River, 4000 ft., *Allison*, B.; Drakensbergen in Basutoland, *Sanderson*, 628.

DISTRIBUTION: Tembuland. East Griqualand. Natal. Orange Free State (Bethlehem, Ventersburg). Transvaal (Magaliesberg, Mooi River, near Heidelberg, Barberton, Pilgrim's Rest, Johannesburg, Pretoria, Carolina).

SESUTO: *Lekhōlela la Matēbēle*. The "Lekhōlela" of the Matabele. *Lekōesha*. See *E. flaccida*. *Moisatōlea*. See *E. hians*. See also note under *E. hians*.

**E. calanthoides**, Schltr.

Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft. *Allison*; Van Reenen, 5-6000 ft., *Wood*, 5569.

DISTRIBUTION: Orange Free State (no locality). Transvaal (near Nylstroom, Potgieter's Rust).

**E. subintegra**, Rolfe.

Natal, damp places Oliver's Hoek, sources of Tugela River, 5000 ft., *Allison*, 8.

DISTRIBUTION: Endemic.

**E. Zeyheri**, Hook, f.

Basutoland, without precise locality, *Bryce*; Natal, Oliver's Hoek, source of the Tugela River, 4000 ft., *Allison*.

DISTRIBUTION: Tembuland. East Griqualand. Natal. Transvaal, (Magaliesberg, near Johannesburg, near Lydenburg, Potchefstroom, Ermelo, Pilgrim's Rest, Heidelberg).

**E. leontoglossa**, Reichb. f.

Veld and mountain slopes. 5-10 in. high, flowers yellow, or green and yellow. Summer. A. *Dieterlen*, 405a! 896!; Witteberg, *Mrs. Barber*, 647; in the valley of the Eland's River, near the Mont-aux-Sources, 6-7000 ft., January, *Flanagan*, 1985!; Natal, near Van Reenen, 5-6000 ft., *Wood*, 7545; hills Polela, *Mrs. Clarke*, 49.

DISTRIBUTION: Tembuland. East Griqualand. Orange Free State (Bethlehem). Transvaal (Magaliesberg, Lydenburg, Mac Mac, Pretoria, Barberton, Johannesburg, Crocodile River).

SESUTO: *Leköhlela*, and *Lekoessa*. See *E. flaccida*.

**E. Sankeyi**, Rolfe.

Harrismith, *Sankey*, 306.

DISTRIBUTION: Endemic.

**E. oliveriana**, Bolus.

Mountains near the farm, Bester's Vlei, 6400 ft., December-January, Bolus, 8300!; in the valley of the Eland's River and Bester's Vlei Mountains, 6000 ft., December-January, *Flanagan*, 1986!; Natal, Van Reenen, 5-6000 ft., December, *Wood*, 7545.

DISTRIBUTION: Stockenstrom. King William's Town. Tembuland. East Griqualand. Natal. Transvaal (Barberton, Hooge Veld).

**E. aculeata**, Spreng.

Plateau at "Lithayaneng." 12 in. high, flowers pure white. Spring-Summer. *A. Dieterlen*, 856!

DISTRIBUTION: Cape. Stellenbosch. Caledon. Riversdale. George. Knysna. Humansdorp. Uitenhage. Port Elizabeth. Albany. Somerset East. Tembuland. Transvaal (Barberton).

SESUTO: *Lekhōlela*. See *E. flaccida*.

**E. foliosa**, Bolus.

Mountain slopes and plateau at Malavaneng. 8-18 in. high, flowers green, yellow and crimson, or dark violet and green. Summer. *A. Dieterlen*, 739! 865!; Natal, Van Reenen's Pass, 5-6000 ft., *Wood*, 5863.

DISTRIBUTION: Transkei. Tembuland. East Griqualand. Natal. Zululand. Swaziland. Orange Free State (no locality). Transvaal (Houtbosch, near Heidelberg, Carolina, Eland's Spruit Range, Belfast).

SESUTO: *Lekhōlela*. See *E. flaccida*. 'Mametsana. See *E. Flanaganii*.

MYSTACIDIUM, *Lindl.***M. gracile**, Harv.

Natal, Niginya, 5500 ft., October, flowers cream, *Wood*, 10615!

DISTRIBUTION: Bedford. Stutterheim.

BRACHYCORYTHIS, *Lindl.***B. Allisoni**, Rolfe.

Natal, in damp places at Oliver's Hoek, sources of the Tugela River, 4000 ft., *Allison*.

DISTRIBUTION: Endemic.

**B. Tysoni**, Bolus.

Damp spots on slopes and plateau. 8-15 in. high, flowers white and pink. Summer. *A. Dieterlen*, 481!; grassy slopes at foot and near summit of Quaqua Mtn. Witzie's Hoek, c. 6000 ft., January. Flowers reddish white. *Thode*, 51!; Natal, sources of Tugela River at Oliver's Hoek, 4000 ft., *Allison*.

DISTRIBUTION: Bedford. Tembuland. East Griqualand. Transvaal (Botsabelo, Houtbosch, Belfast).

SESUTO: 'Mametsana a manyenyane. The little mother of the small water. The tubers are eaten by children.



**B. virginea**, Rolfe.

Sides and summit of Mont-aux-Sources, 8-9000 ft., January, *Flanagan*, 1982!, October, *Mann in Herb. Marloth*, 2883!; Natal, Van Reenen's Pass, 6-7000 ft., *Schlechter*.

DISTRIBUTION: Endemic.

SCHIZOCHILUS, *Sond.*

**S. Zeyheri**, Sond.

Natal, near swamps, Oliver's Hoek Pass, summit of the Drakensberg Range. January. Flowers yellow, *Wood*, 3425!

DISTRIBUTION: Fort Beaufort. Stockenström. King William's Town. Transkei. East Griqualand. Natal.

**S. angustifolius**, Rolfe.

Marsh near Harrismith, *Sankey*, 256!; Natal, stony slopes, Drakensberg, near Tugela hills, January, flowers white, *Wood*, 3444!

DISTRIBUTION: Endemic.

HOLOTHRIX, *L. C. Rich.*

**H. Thodei**, Rolfe.

In stony and grassy places at the summit of Quaqua Mountains, Witzie's Hoek, 7500 ft., *Thode*, 48.

DISTRIBUTION: Endemic.

**H. incurva**, Lindl.

Stony and grassy places on the summit of Quaqua Mountain, Witzie's Hoek, c. 6900ft, February, Flowers greenish, *Thode*, 48!; Natal, Drakensberg Range near Van Reenen, 5-6000 ft., *Haygarth in Herb. Wood*.

DISTRIBUTION: Cape. Swellendam. Knysna.

Thode appears to have collected two species under the above numbers. In the Bolus Herbarium his No. 48 is *H. incurva*.

**H. parvifolia**, Lindl.

Natal, Van Reenen, *Krook, Penther*, 871.

DISTRIBUTION: Cape. Swellendam. Knysna.

**H. rupicola**, Schltr.

Slopes of the Mont-aux-Sources, 8-9000 ft., January, *Flanagan*, 1981!

DISTRIBUTION: Clanwilliam?

**H. orthoceras**, Reichb. f.

Natal, Drakensberg Range, *Fannin in Herb. Sanderson*, 706; sources of the Polela River, 6–7000 ft., *Evans*, 617.

DISTRIBUTION: Albany. Stockenstroom. King William's Town. Transvaal (Barberton. Houtbosch).

**H. scopularia**, Reichb. f.

Slopes of the Mont-aux-Sources, 8–9000 ft., January, *Flanagan*, 1980!; Wittebergen, 6–8000 ft., *Drège*.

DISTRIBUTION: Transvaal (Barberton).

HUTTONAEA. *Harv.***H. fimbriata**, Reichb. f.

Natal, Van Reenen, *Krook, Penther*, 320.

DISTRIBUTION: East Griqualand.

**H. pulchra**, *Harv.*

Natal, shady places at Van Reenen, 5000 ft., March, *Schlechter*, 6921!

DISTRIBUTION: Stockenstroom. Transkei. East Griqualand. Orange Free State.

**H. oreophila**, Schltr.

Natal, near Van Reenen, 6900 ft., March, *Schlechter*, 6931!; Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*, 7.

DISTRIBUTION: Endemic.

**H. grandiflora**, Rolfe.

Rocky grassy ledges near the summit of Mapedi's Peak, Witzie's Hoek, c. 7980 ft., February, flowers white, *Thode*, 49!

DISTRIBUTION: Endemic.

HABENARIA. *Willd.***H. anguiceps**, Bolus.

Near Harrismith, *Krook; Penther*, 123; Natal, Van Reenen, *Penther*, 87.

DISTRIBUTION: Uitenhage. Albany.

**H. foliosa**, Reichb. f.

Mountain slopes near the Mission Station. 10–24 in. high, flowers cream or pale yellow, sweet-scented. Summer–Autumn. *A. Dieterlen*, 688!; grassy slopes of Quaqua Mtn., Witzie's Hoek, c. 6850 ft., February, flowers greenish, *Thode*, 50!; Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*, 37.

DISTRIBUTION: Swelendam. Uitenhage. Port Elizabeth. Bathurst. Albany. Somerset East. Transkei. Tembuland. East Griqualand. Natal.

SESUTO: 'Mametsana. Mother of the small water.

**H. laevigata**, Lindl.

Harrismith, 7500 ft., *Sankey*, 260; near Bester's Vlei, January-February, *Miss Jacobsz!*, *Bolus!*; near Harrismith, c. 5000 ft., February, *Wood!*

DISTRIBUTION: Albany. Transkei. Tembuland. East Griqualand. Transvaal (near Bergendal).

**H. malacophylla**, Reichb. f.

Natal, in woods at Polela, 4-5000 ft., April, *Wood*, 4586!

DISTRIBUTION: Stockenstroom. Transkei. Tembuland. East Griqualand.

**H. Barbertoni**, Kränzl. & Schltr.

Veld and plateau. 12-18 in. high, flowers white. Summer. *A. Dieterlen*, 480!

DISTRIBUTION: Transvaal (Barberton, Ermelo, Pretoria).

SESUTO: 'Mametsana. Mother of the small water.

**H. polypodantha**, Reichb. f.

Natal, in thorny bush by the Upper Tugela River, *Gerrard*, 1554.

DISTRIBUTION: Queenstown.

**H. orangana**, Reichb. f.

Harrismith, 7500 ft., *Sankey*, 263; Natal, Oliver's Hoek, in wet places near the sources of the Tugela River, 5000 ft., *Allison*, 14.

DISTRIBUTION: Transvaal (Belfast, near Pilgrim's Rest and Sabie Falls, Bamboo Mountains).

**H. dives**, Reichb. f.

Veld, near the Mission Station. 12-18 in. high, flowers white. Summer (January). *A. Dieterlen*, 483!

DISTRIBUTION: Tembuland. Natal.

SESUTO: 'Mametsana. Mother of the small water. *Lekoessa*. See *Eulophia flaccida*.

**H. tetrapetala**, Kränzl.

Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*; Van Reenen, *Krook*; *Penther*, 71.

DISTRIBUTION: Transkei. East Griqualand. Transvaal (Johannesburg, Barberton, Houtbosch).

**H. cornuta**, Lindl.

Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*, 21.

DISTRIBUTION: Transkei. Pondoland. East Griqualand. Transvaal (Houtbosch).

**H. clavata**, Reichb. f.

Mountain slopes and plateau. 10-20 in. high, flowers green and white. Summer. *A. Dieterlen*, 488!; Harrismith, 6500 ft., *Sankey*, 259; Bester's Vlei, near Witzie's Hoek, 5300 ft., *Bolus*, 13459.

DISTRIBUTION: Bedford. Stockenstroom. King Williams Town. Komgha. Transkei. Tembuland. Pondoland. Natal. Transvaal (Houtbosch, Wilge River, Belfast, Lake Chrissie, Ermelo, Spion Kop, Barberton, Pietersburg, Wonderfontein).

SESUTO: 'Mametsana. Mother of the small water.

**H. dregeana**, Lindl.

Mountain slopes. 10-15 in. high, flowers greenish. Summer-Autumn. *A. Dieterlen*, 487!; Harrismith, *Sankey*, 261; Natal, Oliver's Hoek, source of the Tugela River, 5000 ft., *Allison*, 24!; Van Reenen, *Penther*, 93.

DISTRIBUTION: Stockenstroom. Transkei. Tembuland. East Griqualand. Transvaal (Lydenburg, Ermelo, Belfast).

SESUTO: 'Mametsana. Mother of the small water.

SATYRIUM, Sw.

**S. Atherstonei**, Reichb. f.

Natal, Oliver's Hoek, sources of Tugela River, 5000 ft., *Allison*, 28.

DISTRIBUTION: Albany. Pondoland. Transvaal (Lydenburg, Mac Mac, Houtbosch, Belfast, Nyl River, Witbank, Merwe Station).

**S. microrrhynchum**, Schltr.

In turf at the summit of the Mont-aux-Sources, 11000 ft., *Thode*.

DISTRIBUTION: Endemic.

**S. parviflorum**, Sw.

Mountain slopes and plateau. 10-20 in. high, flowers yellow, badly scented, leaves shiny. Summer. *A. Dieterlen*, 494!; south slopes of plateau, flowers greenish yellow, *Phillips*, 662!; Harrismith, *Sankey*, 266, 272; Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*.

DISTRIBUTION : Paarl. George. Knysna. Port Elizabeth. Uitenhage. Bathurst. Komgha. Transkei. East Griqualand. Transvaal (Lydenburg, Spitz Kop, Houtbosch, Oliphant's River, Belfast, Barberton, Witbank).

SESUTO : 'Mametsana. Mother of the small water (cited in the "Flora Capensis" as a locality).

**S. aphyllum**, Schltr.

Bester's Vlei, near Harrismith, January, *Bolus*.

DISTRIBUTION : Albany. Queenstown. Cradock. Tembuland. East Griqualand. Natal. Zululand. Transvaal (Donkerhoek).

**S. neglectum**, Schltr.

Harrismith, *Sankey*, 271; Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*; slopes of the Drakensbergen, *Wood*, 3418.

DISTRIBUTION : Transkei. East Griqualand. Transvaal (Houtbosch, Barberton).

**S. longicauda**, Lindl.

Veld, mountain slopes and plateau. 12-20 in. high, flowers white or pink. Summer. *A. Dieterlen*, 244! 485!; Harrismith, *Sankey*, 268, 269; Natal, summit Amawahqua Mtn., 6-7000 ft., April, flowers a delicate pink, *Wood*, 4617!; Oliver's Hoek, 5000 ft., *Allison*, Q.U.; south slopes of plateau, flowers pinkish, *Phillips*, 684!, flowers pale pink, dark above, *Phillips*, 865!; Bester's Vlei, near Witzie's Hoek, 5900 ft., December-January, *Bolus*, 13482!

DISTRIBUTION : Albany. Stockenstroom. Queenstown. Komgha. Tembuland. Pondoland. East Griqualand. Transvaal (Barberton, Lydenburg, Belfast, near Donkerhoek).

SESUTO : *Lekoessa*. See *Eulophia flaccida*. 'Mametsana. Mother of the small water. (Cited in the "Flora Capensis" as a locality).

**S. cristatum**, Sond.

Mountain slopes and plateau. 12-24 in. high, flowers pink, or whitish and crimson. Summer. *A. Dieterlen*, 636a! 636b!; Natal, Oliver's Hoek, 4000 ft., *Allison*; near Van Reenen, 5-6000 ft., *Wood*, 5533.

DISTRIBUTION : Port Elizabeth. Bedford. Stockenstroom. Queenstown. Somerset East. Tembuland. Pondoland. East Griqualand. Orange Free State (no locality). Transvaal (Houtbosch, Lydenburg, Barberton, Belfast, Ermelo, Middleburg).



SESUTO: 'Mametsana. Mother of the small water. *Lekhōlela la Baseng*. The "Lekhōlela" of the Baseng (the name of a Basuto clan).

**S. ocellatum**, Bolus.

Mountain slopes and plateau. 12-20 in. high, flowers yellow. Summer. *A. Dieterlen*, 486!; Harrismith, *Sankey*, 270; Natal, Oliver's Hoek, 4-5000 ft., *Allison*, C., 29.

DISTRIBUTION: Fort Beaufort. Stockenstroom. Komgha. East Griqualand. Transvaal (Lydenburg, Houtbosch, Pretoria, Ermelo, Barberton).

SESUTO: 'Mametsana. Wrongly cited in the 'Flora Capensis' as a locality.

MONADENIA, *Lindl.*

**M. Basutorum**, Rolfe.

Basutoland. Heathy summits of the Drakensberg Range, 10000 ft., *Thode*.

DISTRIBUTION: Endemic.

HERSCHELIA, *Lindl.*

**H. Baurii**, Kränzl.

Natal, Bushman's River Valley, 6-8000 ft., flowers bluish-purple, *Wood*, 10599.

DISTRIBUTION: Tembuland. Transvaal (Houtbosch, Barberton, Middleburg.)

DISA, *Berg.*

**D. stachyoides**, Reichb., f.

In the valley of the Eland's River, near the Mont-aux-Sources, 6-7000 ft., January, *Flanagan*, 1983!; Harrismith, *Sankey*, 262; Natal, Drakensberg Range, 5-6000 ft., *Wood*, 5146.

DISTRIBUTION: Tembuland. East Griqualand. Natal. Transvaal (Lydenburg, Barberton, Elandspruit Mtns., Houtbosch).

**D. Sankeyi**, Rolfe.

Fikilemutu Pass, Drakensberg, Matatiele Dist., 7500 ft., February, *McLoughlin*, 204!; Harrismith, *Sankey*, 264.

DISTRIBUTION: Endemic.

**D. fragrans**, Schltr.

Grassy slopes of Quaqua Mtns. and Mopedi's Peak, Witzie's Hoek, 6800-8100 ft., March, flowers pale purple or whitish, sweet-scented.

*Thode*, 55; Mont-aux-Sources, 8-9000 ft., *Thode*; Harrismith, *Krook*, *Penther*, 124; Tsitsa footpath, Dist. Maclear, c. 7550 ft., March, flowers very pale pink with purple spots, leaves blotched with purple, *Galpin*, 6837!; Natal, Van Reenen's Pass, March, *Penther*, 86!; summit of Amawahqua Mtn., 6800 ft., *Wood*, 4565!

DISTRIBUTION: East Griqualand. Transvaal (Houtbosch).

**D. polygonoides**, Lindl.

Mountain slopes and plateau. 10-20 in. high, flowers red and pink. Summer. *A. Dieterlen*, 489!

DISTRIBUTION: George. Albany. Somerset East. Pondoland. Natal. Delagoa Bay.

SESUTO: '*Mametsana* (wrongly cited in the "Flora Capensis" as a locality). *Lekhōlela la Basotho*.

**D. chrysostachya**, Sw.

Mountain slopes and plateau. 10-20 in. high, flowers yellow and red. Summer (December-February). *A. Dieterlen*, 131!; Natal, Oliver's Hoek, sources of the Tugela River, 5000 ft., *Allison*, 31.

DISTRIBUTION: Cape. Swellendam. Riversdale. George. Knysna. Uitenhage. Bathurst. Albany. Komgha. East Griqualand. Swaziland. Orange Free State (no locality). Transvaal (Barberton, Botsàbelo, Belfast).

SESUTO: *Mohopung*. Meaning unknown. '*Mametsana*. (Wrongly cited in the 'Flora Capensis' as a locality.)

**D. MacOwani**, Reichb. f.

Natal, Oliver's Hoek, 4000 ft., *Allison*, 35.

DISTRIBUTION: Victoria East. Cathcart. Transkei. Pondoland. East Griqualand. Swaziland. Orange Free State (no locality). Transvaal (Barberton, Botsàbelo, Middleburg).

**D. rhodantha**, Schltr.

Natal, swamps at Van Reenen, *Wood*, 4527.

DISTRIBUTION: East Griqualand. Transvaal (between Middleburg and Pretoria).

**D. Thodei**, Schltr.

Grassy banks of a streamlet on the slopes of the Caledon Range, 7900-8300 ft., *Thode*, 53.

DISTRIBUTION: Endemic.

**D. Cooperi**, Reichb. f.

Hollow places on mountain slopes. 15-24 in. high, flowers pink and white. Summer. *A. Dieterlen*, 132!; Bester's Vlei, near Witzie's

Hoek, January, *Bolus*, 8292!; *Miss Jacobsz in Herb. Bolus*!; near Zaai Hoek, *Thode*; near Harrismith, *Sankey*, 266, *Cooper*, 1098, 1871; Natal, Van Reenen, 5500 ft., January, flowers rosy-white, *Wood*, 8751!; Oliver's Hoek, 5000 ft., *Allison*, 27.

DISTRIBUTION: East Griqualand. Swaziland. Transvaal (Lydenburg, Middleburg, Ermelo).

SESUTO: '*Mametsana*. (Wrongly cited as a locality in the 'Flora Capensis.')

**D. crassicornis**, Lindl.

Wittebergen, 7-8000 ft., *Drège*, 3577.

DISTRIBUTION: Knysna. Uitenhage. Bedford. Fort Beaufort. Somerset East. Stockenstroom. King William's Town. Komgha. Transkei. Pondoland. East Griqualand. Natal.

**D. crassicornis**, Lindl., forma.

Ravine and mountain slopes. 9-13 in. high, flowers white with magenta spots. Summer. *A. Dieterlen*, 751!

DISTRIBUTION: Endemic.

SESUTO: '*Mametsana*. This is a much smaller plant, with smaller flowers than in the type. Mrs. Bolus, to whom I showed the specimen, thinks it only a form of the above.

**D. frigida**, Schltr.

Grassy spots on the summit of the Mont-aux-Sources, c. 8850 ft., January, flowers purple. *Thode*, 54!

DISTRIBUTION: Endemic.

**D. Cephalotes**, Reichb. f.

Rocky grassy ledges, near the summit of Mapedi's Peak, Witzie's Hoek, c. 7980 ft., February, flowers white with purple spots, *Thode*, 56!; Bester's Vlei, near Harrismith, *Miss Jacobsz*; Natal, slopes of the Drakensbergen, near the Tugela River, 5000 ft., *Buchanan in Herb. Sanderson*; Oliver's Hoek, 5000 ft., *Allison*, 2; stony hills near Van Reenen, 7000 ft., *Schlechter*, 6933.

DISTRIBUTION: Stockenstroom. Queenstown. Stutterheim. Somerset East. Tembuland.

**D. oreophila**, Bolus.

Harrismith, *Sankey*, 255; Natal, Oliver's Hoek Pass, January, flowers pink, *Wood*, 3413!; slopes of Drakensbergen, *Wood*, 3417!

DISTRIBUTION: Transkei. Tembuland. East Griqualand.

**D. patula**, Sond.

Natal, Oliver's Hoek, 5000 ft., *Allison*, N

DISTRIBUTION: Albany. Stockenstroom. Queenstown. Transkei. Transvaal (Mac Mac, Lydenburg).

**D. nervosa**, Lindl.

Natal, Van Reenen, 5-6000 ft., *Wood*, 6564; Polela, Ixopo River, *Mrs. Clarke*, 66.

DISTRIBUTION: Pondoland.

**D. pulchra**, Sond.

Nelson's Kop, *Cooper*, 978; Natal, near Polela, *Clarke*.

DISTRIBUTION: Fort Beaufort. Victoria East. Stockenstroom. Queenstown. East Griqualand.

**D. porrecta**, Sw.

Mountain slopes and plateau. 10-22 in. high, flowers red and yellow. Summer. *A. Dieterlen*, 479!

DISTRIBUTION: Uniondale. Uitenhage. Albany. Somerset East. Graaff Reinet. Transkei.

SESUTO: 'Mametsana. "*Lekhōlela*." See *Eulophia flaccida*. (Wrongly cited in the "Flora Capensis" as a locality.)

BROWNLEE, *Harv.*

**B. parviflora**, Harv.

Stony spots on the mountain slopes and plateau. 9-17 in high, flowers white. Summer. *A. Dieterlen*, 765!; Natal, stony places near Van Reenen, 7000 ft., *Schlechter*, 6942.

DISTRIBUTION: Albany. Bedford. Victoria East. Stockenstroom. Queenstown. Stutterheim. King William's Town. Transkei. East Griqualand. Somerset East. Transvaal (Barberton, Houtbosch, Belfast).

SESUTO: 'Mametsana.

**B. Galpini**, Bolus.

Mont-aux-Sources, 7-8000 ft., *Thode*; Natal, near Van Reenen's Pass, 4-6000 ft., *Wood*, 5660; February, flowers white, *Wood*, 9278!; *Krook*, 88.

DISTRIBUTION: East Griqualand. Transvaal (Barberton, Houtbosch, Bamboo Mountain).

**B. recurvata**, Sond.

Drakensberg Range, Satsanna's Peak, 8750 ft., March, *Galpin*, 6840.

DISTRIBUTION: Uitenhage. Albany. Stockenström. Cathcart. Somerset East. Tembuland.

**B. monophylla**, Schltr.

Rocky grassy ledges, near the summit of Mopedi's Peak, Witzie's Hoek, *Thode*, 52.

DISTRIBUTION: Endemic.

PTERYGODIUM, *Sw.*

**P. hastatum**, Bolus.

Damp and sheltered spots on mountain slopes. 7-13 in. high, flowers cream. Summer. *A. Dieterlen*, 687!; rocky grassy spots on the summit of Quaqua Mtn., c. 6900 ft., February, flowers whitish, *Thode*, 57!; Natal, Oliver's Hoek, 5000 ft., *Allison*, T.; near Van Reenen, 5000 ft., *Schlechter*, 6923.

DISTRIBUTION: Transkei. Barberton.

SESUTO: 'Mametsana a manyenyane. Little mother of the small water.

**P. leucanthum**, Bolus.

Grassy slopes of Mapedi's Peak, Witzie's Hoek, c. 7500-7800 ft., February, flowers greenish, *Thode*, 57b!

DISTRIBUTION: Tembuland. Fingoland.

**P. sp.**

Fikilemutu Pass, Drakensburg, Matatiele District, 7500 ft., February, *McLoughlin*, 202!

This is unnamed in the Bolus Herbarium.

CORYCIUM, *Sw.*

**C. tricuspidatum**, Bolus.

Mountain slopes. 6-20 in. high, flowers cream and brownish. Summer. *A. Dieterlen*, 484b!

DISTRIBUTION: Cradock. East Griqualand. Natal.

SESUTO: 'Mametsana.

**C. magnum**, Rolfe.

Harrismith, *Sankey*, 273; Natal, near the Drakensberg Range, *Wood*, 3424.

DISTRIBUTION: Bedford. Albany. Somerset East. Transkei. East Griqualand. Natal. Transvaal (Barberton, Houtbosch).



**C. nigrescens**, Sond.

Mountain slopes. 6-20 in. high, flowers brown. Summer. *A. Dieterlen*, 484a!; Bester's Vlei, near Harrismith, 5400 ft., January-February. *Miss Jacobsz in Herb. Bolus*, 13515!; Harrismith, *Sankey*, 267; Natal, Van Reenen. March, *Schlechter*, 6963!; Satsanna's Peak on the Drakensberg Range, 9200 ft., March, *Galpin*, 6844; Fikilemute Pass, Drakensberg, Matatiele District, 8000 ft., February, *McLoughlin*, 200!

DISTRIBUTION: George. Alexandria. Albany. Fort Beaufort. Stockenström. Cradock. Transkei. Tembuland. East Griqualand. Transvaal (Barberton, near Bergendal, Belfast, Ermelo).

SESUTO: 'Mametsana (wrongly cited in the "Flora Capensis" as a locality).

DISPERIS, *Sw.*

**D. Cooperi**, Harv.

Plain on the top of the Drakensberg Range, near Nelson's Kop, *Cooper*, 1100.

DISTRIBUTION: Endemic.

**D. Allisonii**, Rolfe.

Natal, Oliver's Hoek, 5000 ft., *Allison*, 8.

DISTRIBUTION: Endemic.

**D. Kermesina**, Rolfe.

Natal, Oliver's Hoek, 5000 ft., *Allison*, 9.

DISTRIBUTION: Endemic.

**D. Tysoni**, Bolus.

Mountain slopes and plateau. 8-13 in. high, flowers carmine. Summer. *A. Dieterlen*, 482!; Natal, grassy hill at Van Reenen, 5-6000 ft., March, *Wood*, 5545!; Bester's Vlei, near Harrismith, c. 5300 ft., December-January, *Miss Jacobsz in Herb. Bolus*, 6859!; Drakensberg, Satsanna's Peak, District Mt. Fletcher, c. 9300 ft., March, *Galpin*, 6843!

DISTRIBUTION: Somerset East. Tembuland. East Griqualand Transvaal (Belfast).

SESUTO: 'Mametsana a manyenyane. Little mother of the small water.

**D. concinna**, Schltr.

Natal, Mohlamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: Transvaal (near Wilge River).

**D. bicolor**, Rolfe.

Natal, Oliver's Hoek, 5000 ft., *Allison*, 4.

DISTRIBUTION : Endemic.

**D. flava**, Rolfe.

Natal, Oliver's Hoek, 5000 ft., *Allison*, 3.

DISTRIBUTION : Endemic.

**D. cardiophora**, Harv.

Natal, Oliver's Hoek, 5000 ft., *Allison*, 22; near Van Reenen, 5500 ft., *Schlechter*, 6957.

DISTRIBUTION : Stockenstroom. Tembuland.

**D. Macowani**, Bolus.

Natal, among shrubs at Van Reenen, 7000 ft., *Schlechter*, 6937.

DISTRIBUTION : George. Albany. Somerset East.

**D. Fanninia**, Harv.

Orange Free State, woods on the Drakensberg Range, *Cooper*, 1092; Basutoland, without precise locality, *Cooper*, 3615; Natal, Drakensberg Range, *Wood*, 626; Oliver's Hoek, 5000 ft., *Allison*, Z.; shady places near Van Reenen, 6800 ft., March, *Schlechter*, 6929!

DISTRIBUTION : Transkei. East Griqualand. Transvaal (Houtbosch).

## IRIDEAE.

MORAEA, *Linn.***M. spathacea**, Ker.

Damp spots on river banks. 20–30 in. high, flowers yellow and brown. Spring (September–November). *A. Dieterlen*, 354!; Natal, Mooi River, 6000 ft., September, *Schlechter*, 3340!

DISTRIBUTION : Paarl. Knysna. George. Albany. Queenstown. Stockenstroom. Komgha. Tembuland.

SESUTO : *Tele ea nōka*. The "Tele" of the river. *Tele ekholo*. The big "Tele." The leaves are plaited into ropes.

var. **natalensis**, Bkr.

Banks of rivers and mountain slopes. 46–60 in. high, flowers yellow. Spring. Mathokone, Leribe District. *A. Dieterlen*, 737!; Natal, Van Reenen, 5600 ft., December, flowers deep pink with an oblong yellow blotch, *Wood*, 4526!

DISTRIBUTION : Komgha. East Griqualand. Transvaal (Barberton).

SESUTO: *Tele-roka*. The "Tele" of praise. The leaves are plaited into ropes.

**M. setacea**, Ker.

Veld and mountain slopes. 7-25 in. high, flowers mauve. Spring. *A. Dieterlen*, 324!

DISTRIBUTION: Komgha.

SESUTO: *Qeqoe*. Meaning unknown. The native children eat the corms.

**M. natalensis**, Bkr.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*, 8255!; Natal, summit of Drakensberg, 5-6000 ft., January, *Wood*, 3442!; near the sources of the Tugela River, *Allison*!

DISTRIBUTION: Natal.

**M. edulis**, Ker.

Veld and mountain slopes. 20-50 in. high, flowers mauve or yellow. Spring. *A. Dieterlen*, 186! 187!

DISTRIBUTION: Malmesbury. Cape. Swellendam. Mossel Bay.

SESUTO: *Tele*. Meaning unknown. *Tele Tsikoane*. Meaning unknown. ("Tsikoane" is a name of a mountain near Hlotse and also the proper name of women in Basutoland). Madame Dieterlen notes that No. 186 (pale mauve flowers with white marking) is rare, only being known in one locality, while No. 187 (yellow flowers) is a common weed becoming a pest in cultivated lands. Cattle, if not accustomed to the plant, die in a few hours after eating it, but if dosed in time with the ashes from the incinerated plants, mixed with the dregs of Kaffir beer, they can be cured.

**M. tripetala**, Ker.

Mountain slopes. 6-10 in. high, flowers mauve. Spring (October), *A. Dieterlen*, 813!; slopes of the Mont-aux-Sources, 7-8000 ft., January, *Flanagan*, 2014! 2037! 2041!; summit of the Drakensbergen, sources of the Tina River, Dist. Maclear, 8750 ft., March, flowers white, *Galpin*, 6846!

DISTRIBUTION: Van Rhynsdorp. Cape. Paarl. Caledon. Natal.

SESUTO: *Thèlo ea nōkō*. The stolen food of the porcupine. *Tloang*. Meaning unknown. *Khahla e nyenyane*. The small thing which pleases.

**M. sp.** (material insufficient).

Summit of Drakensberg, near Lehana Pass, 8500 ft., *Galpin*, 2322!

SYRINGODEA, *Hook. fil.***S. Flanaganii**, Bkr.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2024!

DISTRIBUTION: King William's Town. Komgha.

**S. bicolor**, Bkr.

Wittebergen, 7-8000 ft., *Drège*, 3498.

See note in 'Flora Capensis,' VI, 35.

**S. luteo-nigra**, Bkr.

Drakensbergen, on Doodman's Krans Mountain, c. 9000 ft., March. Flowers yellow, *Galpin*, 6848!

DISTRIBUTION: Endemic.

ROMULEA, *Maratti.***R. Thodei**, Schltr.

Wet sandy places on the summit of the Mont-aux-Sources, c. 8700 ft., January, flowers purple, *Thode*, 58!

DISTRIBUTION: Endemic.

ARISTEA, *Soland.***A. anceps**, Eckl.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*!

DISTRIBUTION: Albany. Aliwal North. Transkei. East Griqualand. Natal. Swaziland. Transvaal (Houtbosch).

**A. torulosa**, Klatt, var. *monostachya*, Bkr.

Mountain slopes. 7-18 in. high, flowers dark blue. Summer. *A. Dieterlen*, 434!; mountains near Bester's Vlei, Witzie's Hoek, 5400 ft., December, *Bolus*!

DISTRIBUTION: Natal.

SESUTO: *Lethepu le lenyenyane*. The small "Lethepu."

SCHIZOSTYLIS, *Backh. & Harv.***S. coccinea**, Backh. & Harv.

Bester's Vlei, near Witzie's Hoek, *Miss Jacobsz in Herb. Bolus*, 6478!

DISTRIBUTION: Stockenström. Tembuland. East Griqualand. Natal. Swaziland. Transvaal (Rhenoster Poort, Lydenburg).

**S. pauciflora**, Klatt.

Mountain slopes. 30-38 in. high, flowers light pink. Summer. Mechachaneng, Qalo District, *A. Dieterlen*, 917!; Natal, stream near Van Reenen, 5000 ft., March, *Schlechter*, 6920!; damp ground at Van Reenen, 5-6000 ft., February, flowers scarlet, *Wood*, 5611!

DISTRIBUTION: Orange Free State. Transvaal. No precise localities.

SESUTO: *Khahlana*. The small thing which pleases.

HESPERANTHA, *Ker.*

**H. leucantha**, Bkr.

Natal, Oliver's Hoek Pass, *Wood*, 3437!

DISTRIBUTION: Endemic.

**H. Baurii**, Bkr.

Mountain slopes. 3-9 in. high, flowers pink-mauve or white. Spring. *A. Dieterlen*, 609!, plateau, 6-22 in. high, flowers pink. Summer. *A. Dieterlen*, 788!; Natal, Van Reenen, February, *Penther*, 702!; grassy slopes, farm "Woodlands," Dist. Maclear, c. 5600 ft., March, flowers pink, *Galpin*, 6851!

DISTRIBUTION: Tembuland. Pondoland. Natal. Zululand. Orange Free State (no locality). Transvaal (Barberton).

SESUTO: *Khahlana*. The small thing which pleases (788). *Khahlana e nyenyane*. The small thing which pleases. The "bulb" not known to be edible. Madame Dieterlen considers her Nos. 609 and 788 as two distinct species, but I fail to see any specific distinctions. *Khukhu*. A small bulb (609). *Qelo*. Asking (609). *Qeloe*. Asked (609). So-called because children beg the "bulbs" from anyone who has found them. The "bulbs" are eaten.

**H. radiata**, *Ker.*

Mountain slopes. 6-20 in. high, flowers yellow. Spring. *A. Dieterlen*, 805!

DISTRIBUTION: Van Rhynsdorp. Cape. Tulbagh. George. Stellenbosch. Victoria West. Murraysburg. Somerset East. Natal.

SESUTO: *Nala la nonyana*. The nail of the bird. *Khahlana*. The small thing which pleases.

? **H. sp.**

Valley above the Buffalo River Waterfall, c. 8200 ft., March, flowers pink, *Galpin*, 6856!; summit Doodman's Krans Mountain, c. 9650 ft., March, flowers pink, *Galpin*, 6850!

The material I have seen is very scanty. In Mr. Galpin's list, the specimens are cited as *Hesperantha longituba*, Bkr.?



DIERAMA, *K. Koch.***D. pendula**, Bkr.

River banks and mountain slopes. 40–60 in. high, flowers pink or white. Spring. *A. Dieterlen*, 254b!, 254a!; Natal, Drakensberg, *Cooper*, 3177.

DISTRIBUTION: Humansdorp. Port Elizabeth. Alexandria. Albany. Somerset East. Murraysburg. Stutterheim. Stockenstroom. Tembuland. East Griqualand. Natal. Transvaal (Barberton). Orange Free State (no locality).

SESUTO: *Lethepu*. Meaning unknown. The plant is carefully boiled and the preparation is used as a powerful enema. It is sometimes mixed with *Pentanisia variabilis* to weaken its action.

WATSONIA, *Mill.***W. densiflora**, Bkr.

Mountain slopes and plateau. 20–35 in. high, flowers carmine. Summer. *A. Dieterlen*, 233!; Bester's Vlei, near Witzie's Hoek, 6200 ft., December, *Bolus*, 8254!

DISTRIBUTION: Tembuland. Pondoland. East Griqualand. Natal. Swaziland. Transvaal (Barberton). Orange Free State (no locality).

SESUTO: *Khahla*. The thing which pleases. The name "Khahla" is given to all species of *Gladiolus* and to many *Iridaceae* on account of the fine colouring of their flowers. Given as a medicine to calves suffering from diarrhoea.

TRITONIA, *Ker.***T. lineata**, Ker.

River banks and mountain slopes. 13–28 in. high, flowers yellow. Spring. *A. Dieterlen*, 245!; Basutoland, without precise locality, *Cooper*, 3200.

DISTRIBUTION: Mossel Bay. Bathurst. Uitenhage. Albany. Somerset East. Stockenstroom. King William's Town. Komgha. East Griqualand. Natal. Swaziland.

SESUTO: *Khettleleli*. Meaning unknown.

GLADIOLUS, *Linn.***G. maculatus**, Sweet.

Mountain slopes and banks of rivers. 15–30 in. high, flowers yellow and brown. Spring. *A. Dieterlen*, 232!

DISTRIBUTION: Cape. Somerset East. Komgha.

SESUTO: *Khukhurupe*. Meaning unknown.

**G. crassifolius**, Bkr.

Near Harrismith, *Wood*, 4825; Natal, near Tugela, 3-4000 ft., *Wood*, 4407; *Allison*; Polela, *Wood*, 4713.

DISTRIBUTION: Pondoland. East Griqualand. Transvaal (Pretoria, Middleburg).

**G. Ludwigii**, Pappe.

Natal, Polela. 4-5000 ft., *Wood*, 4636.

DISTRIBUTION: Tembuland. East Griqualand.

**G. ochroleucus**, Bkr.

Damp spots on veld. 16-35 in. high, flowers pale yellow and brown. Summer-Autumn. *A. Dieterlen*, 455!

DISTRIBUTION: Tembuland. East Griqualand. Swaziland.

SESUTO: *Khahla*. That which pleases. *Ntantane*. Nice food.

**G. Ecklonii**, Lehm.

Mountain slopes. 12-22 in. high, flowers pink. Autumn. Lelvaleng, Quthing District. *A. Dieterlen*, 689!; Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*!; Orange Free State, on the Drakensbergen, *Cooper*, 1040, 3194, 3198; Natal, upper part of Tugela River, *Allison*; Basutoland, *Bowker*, 1.

DISTRIBUTION: Stockenstroom. Fort Beaufort. Stutterheim. Tembuland. East Griqualand.

SESUTO: *Khahla*. That which pleases. The corms are crushed and cooked and the decoction is drunk to relieve (rheumatic) pains.

**G. purpureo-auratus**, Hook. fil.

Bester's Vlei, near Witzie's Hoek, 5400 ft., December, flowers yellow, common, *Bolus*, 8252!; Natal, upper part of Tugela River, *Allison*.

DISTRIBUTION: Endemic.

**G. Salmoneus**, Bkr.

Drakensbergen, on Tsitsa Footpath, Dist. Maclear, 7550 ft., March, flowers pink, *Galpin*, 6858!

DISTRIBUTION: East Griqualand.

**G. Flanaganii**, Bkr.

Near the summit of the Mont-aux-Sources, 8500 ft., January, *Flanagan*, 1832.

DISTRIBUTION: Endemic.

**G. dracocephalus**, Hook. fil.

Mountain slopes. 5-6 ft. high, flowers reddish-brown. Summer.

*A. Dieterlen*, 454b!; Natal, at foot of Drakensbergen, *Cooper*, 3593; upper part of Tugela River, *Allison*.

DISTRIBUTION: Stutterheim.

SESUTO: *Khahla e kholo*. The big thing which pleases. One of the plants met with in a native doctor's "Lenaka" (a horn used as a receptacle for carrying various medicines).

**G. psittacinus**, Hook.

Mountain slopes. 3-4½ ft. high, flowers bright red with yellow markings. Summer. *A. Dieterlen*, 454a!; Eland's River Valley at the foot of the Mont-aux-Sources, 6000 ft., December, *Bolus*!; Wittebergen, 4500-500 ft., *Drège*, 3502.

DISTRIBUTION: Albert. Natal.

SESUTO: *Khahla e khalo*. See under *G. dracocephalus*.

**G. Saundersii**, Hook. fil.

Slopes and plateaux of high mountains at Machache, Thaba Bosui Distr. 26-35 in. high, flowers red with lighter markings. Summer. *A. Dieterlen*, 774!; Wittebergen summit, *Cooper*, 605.

DISTRIBUTION: Somerset East. Albert. Aliwal North. Natal.

SESUTO: *Khahla ea malōti*. The "Khahla" of the high mountains. The cooked corms are mixed with the food of a person suffering with diarrhoea.

**G. edulis**, Burch.

Veld and mountain slopes, 22-34 in high, flowers cream and mauve. Summer. *A. Dieterlen*, 634!; Botsàbelo, Maseru Dist. Flowers whitish with crimson markings. Winter (June). *A. Dieterlen*, 1026!; Bester's Vlei, near Mont-aux-Sources, 5500 ft., January, *Flanagan*, 2038!; Bester's Vlei, near Witzie's Hoek, 5400 ft., December, *Bolus*!; Nelson's Kop, *Cooper*, 877; Basutoland, *Cooper*, 3317.

DISTRIBUTION: King William's Town. Alexandria. Graaff Reinet. Somerset East. Bechuanaland.

SESUTO: *Khahla e nyenyane*. The small thing which pleases.

**G. Dieterlenii**, Phillips, sp. nov. *Cormus* 2.5 longus, circiter 3 cm. latus. *Folia* 6-8: inferiora caulem amplexa, glabra, laminis brevissimis vel 0; superiora 36-43 longa, 2-7 mm. lata, linearia, acuminata, distincte nervigera, glabra; margines crassae. *Pedunculus* teres, glaber. *Inflorescentia* 9-25 cm. longa, 4-25-florifera. *Spatha* 1.5-2.5 cm. longa, ovata, acuminata, apice acuta. *Tubus* perianthii 1-1.3 cm. longus, cylindricus, paullo curvatus, glaber; lobi 1.5 cm. longi, 8-9 mm. lati, elliptici vel ovato-elliptici, apice retusi mucrona-

tique, glabri. *Filamenta* 1.1–1.7 cm. longa, linearia vel teretia, glabra; : *stamina* 6–7 mm. longa, linearia, basi breve sagittata. *Ovarium* 2–4 mm. longum, 2 mm. latum, ellipsoideum, trigonum, glabrum; *stylus* 1.8–1.9 cm. longus, teres; *lobi* 2 mm. longi, spathulato-lineares.

*Corm* 2.5 cm. long, about 3 cm. broad, covered with fibres which are produced into a short neck above. *Leaves* 6–8, the lowermost or 2 lowermost represented by sheaths only; the upper 36–43 cm. long, 2–7 mm. broad, linear, acuminate, acute, the margins and mid-rib thickened, distinctly veined, glabrous. *Peduncle* terete, glabrous. *Inflorescence* 9–25 cm. long, 4–25-flowered. *Spathe-valves* 1.5–2.5 cm. long, 5–6 mm. broad, ovate, acuminate, acute, sometimes produced in a fine subulate point. *Perianth tube* 1–1.3 cm. long, cylindric, slightly curved, glabrous; *lobes* 1.5 cm. long, 8–9 mm. broad, elliptic and ovate-elliptic, retuse and mucronate at the apex, glabrous. *Filaments* 1.1–1.7 cm. long, linear or terete, glabrous; *stamens* 6–7 mm. long, linear, shortly sagittate at the base. *Ovary* 2–4 mm. long, 2 mm. broad, ellipsoid, trigonous, glabrous; *style* 1.8–1.9 cm. long, terete; *lobes* 2 mm. long, spathulate-linear.

Mountain slopes, 15–30 in. high, flowers pink, *A. Dieterlen*, 445; flowers red, occasional, *Phillips*, 833; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Bolus*, 8253; Natal, Van Reenen, 7000 ft., March, *Schlechter*, 6943; Highlands, 5000 ft., February, *Schlechter*, 6848.

**SESUTO:** *Khahla e nyenyane*. The small thing which pleases. A preparation from this and other plants is used as an enema. Also said to be a cure for headache and lumbago.

Near *G. Woodii*, Bkr., from which it differs in the lower leaf-sheaths being glabrous and the flowers pink.

Baker in the "Flora Capensis" (VI, 144) states that the flowers of *G. Woodii* are dark red. Wood on his ticket No. 618 (the type of the species) notes "flowers dark brown."

#### ANTHOLYZA, Linn.

##### *Antholyza paniculata*, Klatt.

Mountain slopes, 30–45 in. high, flowers reddish-brown. Summer. *A. Dieterlen*, 458!; Bester's Vlei, near Witzie's Hoek, January–February, *Miss Jacobsz in Herb. Bolus*, 830!

**DISTRIBUTION:** Namaqualand Minor. Natal. Zululand. Swaziland. Transvaal (Barberton, Mac Mac).

**SESUTO:** *Khahla ea Bokoni*. The "thing of Zululand" which pleases. *Moloke*. The straight one. A preparation of this plant mixed with water is used as a cure for diarrhoea in people and cattle.

## AMARYLLIDEEAE.

## CURCULIGO, Gaertn.

**C. plicata**, Ait., var. **Barberi**, Bkr.

Mountain slopes. 3-9 in. high, flowers yellow. Spring. *A. Dieterlen*, 459; Natal, grassy hill at Van Reenen, 5500 ft., November, *Wood*, 4689!

DISTRIBUTION: Somerset East. Natal. Griqualand West.

SESUTO: *Leihlo Khomo*. The eye of the cattle. *Leihlo la Khomo*. The eye of the cattle. The bulb is edible.

## HYPOXIS, Linn.

**H. rubella**, Bkr.

Summit of the Mont-aux-Sources, 9500 ft., January. Flowers submerged in water. *Flanagan*, 2024!

DISTRIBUTION: Endemic.

**H. milloides**, Bkr.

Drakensberg, on Tsitsa Footpath, District Maclear, c. 6900 ft., March, flowers bright deep red, *Galpin*, 6862!

DISTRIBUTION: Tembuland. East Griqualand. Natal.

**H. Baurii**, Bkr.

Mont-aux-Sources, c. 6600-7000 ft., October, *Mann in Herb. Marloth*, 2869!; flowers lilac. *A. Bolus in Herb. Guthrie*, 4933!; Bester's Vlei, near Witzie's Hoek, 6400 ft., December, *Bolus*, 8258!; Natal, crevices of rocks at Van Reenen, flowers white to pink, 5-6000 ft., December, *Wood*, 5839!

DISTRIBUTION: Tembuland. East Griqualand.

**H. fliformis**, Bkr.

Damp spots on plateau. 2-6 in. high, flowers yellow. Spring. *A. Dieterlen*, 650!; Natal, Mhlabamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: Queenstown. Komgha. East Griqualand. Natal. Transvaal (Barberton).

SESUTO: *Moliletsane*. The slender "Moli." "Moli" is the Sesuto generic name for the genus *Hypoxis*.

**H. angustifolia**, Lam.

Veld, mountain slopes, and plateau. 4-12 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 639!

DISTRIBUTION: Stockenstroom. Tembuland. Orange Free State (no locality).

SESUTO: *Molinyana*. The small "Moli."



**H. argentea**, Harv., var. **sericea**, Bkr.

Veld and mountain slopes. 4-10 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 176!; south slopes of plateau, above Khaniane, flowers yellow, *Phillips*, 932!

DISTRIBUTION: Swellendam. Uitenhage. Stockenström. Graaff Reinet. Somerset East. East Griqualand. Natal. Orange Free State (Bloemfontein).

SESUTO: *Letsikitlane*. Meaning unknown. The rootstock is eaten by native children.

var. **flaccida**, Bkr.

Mountain slopes. 10-20 in. high, flowers yellow. Spring. *A. Dieterlen*, 536!; damp places in ravine, *Phillips*, 679! 729! 744!

DISTRIBUTION: Albany. Transvaal (Aapie's River). Orange Free State (near Seven Fontein Mission Station).

SESUTO: *Leihlo-Khoma le leholo*. The big eye of the cattle. The rootstock is edible. The rootstock is dried, crushed, mixed with fat, and used to anoint cracks on the teats of cows in milk.

**H. villosa**, Linn. f., var. **scabra** (*ex descr.*).

Veld and mountain slopes. 9-20 in. high, flowers yellow. Spring. *A. Dieterlen*, 310!

DISTRIBUTION: Mossel Bay. Uitenhage. Albany. Somerset East. Tembuland.

SESUTO: *Moli Letaha*. The "Moli" of the damp places. *Lehlaba Kōlōbe*. He who pricks the wild boar. *'Khuoa Ke maoatle*. Plucked by the fools. So named because it is gathered by some of the natives for making ropes in mistake for *H. rigidula*, from which strong ropes are made. Ropes made from the above species soon rot. The rootstock is used as a charm by the native doctors against thunder.

var. **pannosa**, Bkr.

Natal, slopes of the Drakensbergen, *Wood*, 3434.

DISTRIBUTION: Endemic.

**H. obtusa**, Burch.

Natal, Drakensbergen, *Bolus*, 2572.

DISTRIBUTION: Orange Free State (no locality). Bechuanaland. Transvaal (Barberton).

**H. acuminata**, Bkr.

Mountain slopes and plateau. 5-18 in. high, flowers yellow.

Spring-Summer. *A. Dieterlen*, 290! 709! 924!; Natal, grassy places at Van Reenen, 5-6000 ft., November, *Wood*, 6120!

DISTRIBUTION: Natal (Inanda). Transvaal (Pietersburg).

SESUTO: *Moli*. The native generic name for *Hypoxis*. *Molimot-sanyane*. The "Moli" of the small village. *Moliboea*. The hairy "Moli."

### *H. rigidula*, Bkr.

Veld, mountain slopes, and plateau. 10-20 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 230!; Basutoland, without precise locality, *Cooper*, 3241.

DISTRIBUTION: Alexandria. Bathurst. Queenstown. Somerset East. Albert. East Griqualand. Natal. Orange Free State (no locality). Transvaal (Wonderfontein).

SESUTO: *Tieane*. Derived from the verb "ho tiea"—to be strong (or firm). Used to make strong ropes. See note under *H. villosa* var. *scabra*.

The lower pedicels are up to 2.5 cm. long.

### *H. multiceps*, Buching.

Mountain slopes. 6-13 in. high, flowers yellow. *A. Dieterlen*, 149!; Bester's Vlei, near Witzie's Hoek, 6500 ft., December, *Bolus*, 8169!

DISTRIBUTION: Cathcart. Natal. Transvaal (Barberton).

SESUTO: *Molimotsane*. The "Moli" of the small village. *Morethetho*. That which rubs away. Pegs placed in the ground round a village are smeared with a mixture of this plant and *Ipomoea oblongata* as a charm against lightning.

### *H. hemerocallidea*, Fisch. et Mey.

Basutoland, without precise locality, *Cooper*, 3242.

DISTRIBUTION: Tembuland.

### *H. costata*, Bkr. (*ex descr.*).

Mountain slopes, flowers yellow. Summer. *A. Dieterlen*, 229b!; Qoqolosi Peak, flowers yellow. *Phillips*, 986!; Nelson's Kop, *Cooper*, 879.

DISTRIBUTION: Endemic.

SESUTO: *Möli Kharatsa*. The coiling "Moli." Derived from "ho Khara"—to coil oneself up. This is in reference to the curved leaves.

### *H. Rooperii*, Moore.

Veld, mountain slopes, and plateau. 8-30 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 223! 229a!

DISTRIBUTION: Albany. Stockenstroom. Kongha. East Griqualand. Natal. Transvaal (Potchefstroom, Houtbosch, Barberton).

SESUTO: *Moli Kharatsa*. See *H. costata*. As a cure for headache, the rootstock is shaped into a small hollow receptacle in which the blood from the patient's forehead is collected. This is then buried and the patient is cured! *Lotsane*: The small "löli." "Loli" is the name of *Cyperus marginatus*, which this plant resembles in growing erect. Ropes made from the leaves are used in the building of huts, reed enclosures, and for sewing the grain-baskets. The natives distinguish No. 223 from No. 229a, and do not use the latter in their medicinal practices as described above.

### H. sp.

Mountain slope. Flowers yellow. Summer. *A. Dieterlen*, 918!

SESUTO: *Moli*.

The material is too poor for determination.

### ANOIGANTHUS, Baker.

#### A. breviflorus, Bkr.

Mont-aux-Sources, c. 9300 ft., October, *Mann in Herb. Marloth*, 2885!

DISTRIBUTION: Stockenstroom. Fort Beaufort. Somerset East. Graaff Reinet. Tembuland. East Griqualand. Natal. Swaziland.

### APODOLIRION, Bkr.

#### A., cf. A. Ettae, Bkr.

Mont-aux-Sources, 9500 ft., October, *A. Bolus in Herb. Guthrie*!

The material is incomplete.

### CRINUM, Linn.

#### C. longifolium, Thunb.

Veld. 15-35 in. high, flowers pink and white. Spring-Summer.

*A. Dieterlen*, 304!

DISTRIBUTION: Cape. Cathcart. Colesburg. Transkei. Natal. Griqualand West. Bechuanaland.

SESUTO: *Lelutla*. He who trickles. *Motôtse*. Meaning unknown. Used as a medicine in cases of cold.

#### C. Macowani, Bkr.

Natal, Upper Tugela, *Wood*, 5614.

DISTRIBUTION: Transkei. East Griqualand.

AMMOCHARIS, *Herb.***A. falcata**, *Herb.*

Veld. 15–30 in. high, flowers dark crimson. Summer, Hermon, Mafeteng Distr. *A. Dieterlen*, 512!; Caledon River, *Burke*.

DISTRIBUTION: Cape, Uitenhage. Cathcart. Beaufort West. Somerset East. Albert. Komgha. Natal. Griqualand West. Bechuanaland. Transvaal (Magaliesberg).

SESUTO: *Bōka*. Meaning unknown. A thick paste is made from the cooked bulbs with which to repair cracks in clay pots.

BRUNSVIGIA, *Heist.***B. Cooperi**, *Bkr.*

Mountain slopes and plateau. 25–30 in. high, flowers dark pink. Summer (February). *A. Dieterlen*, 42!; Wittebergen, 5–6000 ft., *Drège*, 3518.

DISTRIBUTION: Graaff Reinet. Orange Free State (no locality).

SESUTO: *Lematla*. The strong one. Much used by the witch doctors who wash their divining-bones in a decoction prepared from the plant with the idea of imparting greater accuracy to them. Either alone or mixed with other plants, a medicine is prepared from this and used by barren women who wish to become pregnant.

**B. sphaerocarpa**, *Bkr. (ex descr.)*.

Grassy slopes. Antelope Park, District Maclear, c. 5800 ft., March. Flowers pink, *Galpin*, 6863!

DISTRIBUTION: East Griqualand.

**B. natalensis**, *Bkr.*

Bester's Vlei, near Witzie's Hoek, 6000 ft., December, *Bolus*, 8256!

DISTRIBUTION: Natal.

The flowers are larger than in the type.

NERINE, *Herb.***N. angustifolia**, *Bkr.*

Banks of river in veld. 20–40 in. high, flowers bright pink. Autumn. L'Esperance. District Ladybrand. Orange Free State, *A. Dieterlen*, 776!; in boggy grass places at foot of Quaqua Mountain c. 6850 ft., February, flowers pink. *Thode*, 59!; Natal, Polela Dist. *Adlam*.

DISTRIBUTION : Somerset East. Cradock. Komgha. Transkei. Tembuland. Swaziland. Orange Free State (no locality). Transvaal, (Lydenburg, Barberton).

SESUTO : *Lematlana*. The small strong one. The dry bulbs are crushed and placed in an ox-horn together with other plants and used as a charm against lightning, illness, etc.

**N. pancratioides**, Bkr.

Natal. Waterfall No. 7. Weenen County, 5-6000 ft., *Evans*, 410.

DISTRIBUTION : Natal (Greytown).

CYRTANTHUS, *Ait.*

**C. Flanaganii**, Bkr.

Slopes of the Mont-aux-Sources. 8-9000 ft., January, *Flanagan*, 1824 !

DISTRIBUTION : Endemic.

**C. parviflorus**, Bkr.

Mountain slopes and plateau. 10-20 in. high, flowers reddish-brown. Spring. *A. Dieterlen*, 653 !.

DISTRIBUTION : Port Elizabeth. Stockenstroorn. Komgha. East Griqualand. Transvaal (Barberton).

SESUTO : *Moröloanyane* ou *litsoëna*. The tiny "Morölane" of the monkeys. ("Morölane" means "little strength.")

**C. stenanthus**, Bkr.

Slopes of the Mont-aux-Sources, 6-8000 ft., December-January. *Flanagan*, 2047 ! ; grassy slopes near the top of Plattberg, Harrismith, c. 6900-7200 ft., flowers reddish-green, *Thode* !

DISTRIBUTION : Endemic.

**C. Macowani**, Bkr.

Natal, Polela, 5-6000 ft., flowers scarlet, *Wood*, 11108 !

DISTRIBUTION : Fort Beaufort. Somerset East. Graaff Reinet.

The perianth tube is more slender and the pedicels not so thick as in the type.

**C. O'Brieni**, Bkr.

Natal, Drakensbergen, *Hort. J. O'Brien* ; crevices of rocks, valley of Buffalo River, 5-6000 ft., *Wood*, 4812.

DISTRIBUTION : East Griqualand or endemic.

**C. angustifolius**, Ait.

Slopes of Hlotse hills. Flowers bright red. Summer (January).



*A. Dieterlen*, 897!; Basutoland, without precise locality, *Cooper*, 3224!

DISTRIBUTION: Cape. Queenstown. Graaff Reinet. King William's Town. Natal. Transvaal (no locality).

SESUTO: *Morōloane oa litsoëne*. See *C. parviflorus*.

*C. lutescens*, Herb. var. *Cooperi*, Bkr.

Damp spots on mountain slopes. Flowers yellow. Summer, Poso Kloof. *A. Dieterlen*, 830!

DISTRIBUTION: Stockenstroom. King William's Town. Komgha. Tembuland.

SESUTO: *Morōloane oa litsoëne*. See *C. parviflorus*.

### HAEMANTHUS, *Linn.*

*H. carneus*, Gawl.

Caledon River, *Burke*, 444.

DISTRIBUTION: Somerset East. Graaff Reinet. Transkei. Tembuland. Orange Free State (Rhinoster Kop).

*H. hirsutus*, Bkr.

Mountain slopes. 6–15 in. high, flowers pink. Summer. *A. Dieterlen*, 509!; foot of the Mont-aux-Sources, 6800 ft., January, *Flanagan*, 1830!

DISTRIBUTION: Tembuland. East Griqualand. Natal. Transvaal (Barberton).

SESUTO: *Tsèbè ea phofu*. The ear of the eland. *Sekitla*. The heavy thing. The crushed bulbs are mixed with water, and the mixture is sprinkled round huts, etc., to ward off any harm which may be likely to befall them.

### BUPHANE, *Herb.*

*B. disticha*, Herb.

Veld and mountain slopes. 7–20 in. high, flowers dark crimson. Summer–Autumn. *A. Dieterlen*, 305!; Natal on the Drakensbergen, *Bolus*, 2834.

DISTRIBUTION: Worcester. Uitenhage. Albany. Somerset East. Victoria West. Komgha. Natal. Griqualand West. Bechuanaland.

SESUTO: *Leshoma*. Meaning unknown. *Khutsane ea na ha*. The orphan of the veld. So called because the plants are always found growing quite isolated. Before tin utensils were introduced into

Basutoland, the shepherd boys used the large bulb in which to warm milk. The inside of the bulb was scooped out, filled with milk and then placed on the fire.

VELLOZIA, *Vand.*

**V. viscosa**, Bkr.

Mountain slopes, 10-22 in. high, flowers violet. Spring-Summer. *A. Dieterlen*, 218!; Qoqolosi Peak, flowers pink, leaves viscid, *Phillips*, 977!; Bester's Vlei, near Witzie's Hoek, 6700 ft., December, *Flanagan*, 1845!; *Bolus*, 8257!; Mont-aux-Sources, 8000 ft., *E. Dyke in Herb-Marloth*, 5442!, in *Herb. Musei Austro-Afric.*, 5520!; Natal, on the Drakensbergen, near Tugela Falls, *Wood*, 3439.

DISTRIBUTION: Pondoland. East Griqualand. Transvaal (Houtbosch).

SESUTO: *Mafiroane*. Meaning unknown. Used to make ropes.

DIOSCOREACEAE.

DIOSCOREA, *Linn.*

**D. (Helmia) Mundii**, Bkr.

Bester's Vlei, near Witzie's Hoek, 5600 ft., December, *Bolus*, 8266!; Natal, Van Reenen, 5500 ft., March, *Schlechter*, 6968!

DISTRIBUTION: Knysna.

TESTUDINARIA, *Salisb.*

**T. sylvatica**, Kunth.

Bester's Vlei, near Witzie's Hoek, 5500-6000 ft., December-January. *Bolus*, 8168!; *Flanagan*, 2001!

DISTRIBUTION: Humansdorp. Uitenhage. Port Elizabeth. Albany. Somerset East. Transkei. Tembuland. Natal. Transvaal (Barberton).

LILIACEAE.

ASPARAGUS, *Linn.*

**A. denudatus**, Bkr.

Mountain slopes. Flowers cream. Spring-Summer. *A. Dieterlen* 828!

DISTRIBUTION: Queenstown. Aliwal North. Orange Free State (no locality).

SESUTO: *Leunyeli*. Meaning unknown. This is a name in general use for species of *Asparagus*.

**A. virgatus**, Bkr.

Natal, on the Drakensbergen, *Cooper*, 2248.

DISTRIBUTION: Bedford. Stockenstrom. Somerset East. Pondoland. Natal. Transvaal (Barberton).

**A. declinatus**, Linn.

Ravines and mountain slopes. 20-35 in. high, flowers yellow. Summer. *A. Dieterlen*, 302!

DISTRIBUTION: George. Knysa. Uitenhage. Alexandria. Somerset East. Pondoland.

SESUTO: *Leunyeli*. The young shoots are eaten. To protect a crop from witchcraft, pegs are dipped in a decoction prepared from the roots, and placed at the four corners of the field on which the crop is growing. This, together with *A. stellatus*, enters the "Lenaka" or protective horn of young girls who are undergoing a course of initiation in the national customs.

**A. stellatus**, Bkr. (*ex descr.*).

Ravines and mountain slopes. Flowers cream. *A. Dieterlen*, 301! 944!; Wittebergen, 5-6000 ft., *Drège*, 8589; ravine on west slopes of plateau, *Phillips*, 758!

DISTRIBUTION: Albert.

SESUTO: *Lelala-tau* and *Molata-tau*. He who watches the lion. *Lelala-tau le letšo*. The black "*Lelala-tau*." Parts of the plant are placed in incisions made on the bodies of young girls undergoing the initiation rites, to make them strong. See latter note under *A. declinatus*.

**A. asiaticus**, Linn.

Ravine and mountain slopes. 3-5 ft. high, flowers cream. Summer. *A. Dieterlen*, 346!

DISTRIBUTION: Colesberg. Aliwal North. Griqualand West. Bechuanaland. Transvaal (Pretoria). Natal. Delagoa Bay.

SESUTO: *Leunyeli*. As a charm to ensure victory a Mosuto warrior dips his weapons into a decoction made from this species. Used as a purgative to cure a child of colic brought about by suckling its mother when she is pregnant.

**A. africanus**, Lam.

Ravines and mountain slopes. Flowers whitish. Spring. *A. Dieterlen*, 406!

DISTRIBUTION: Malmesbury. Cape. Swellendam. Uitenhage. Alexandria. Albany. Graaff Reinet. Somerset East. Pondoland. Natal. Griqualand West. Transvaal (Barberton). Bechuanaland.

SESUTO: *Lelala tau le leholo*. The "big one" who watches the lion. The roots are dried and crushed, and the powder rubbed into incisions made on the bodies of boys undergoing the rites of circumcision, to make them brave and strong.

**A. scandens**, Thunb.

Shady spots in ravine. 15-30 in. high, flowers cream. Autumn. Pitseng, Leribe District. *A. Dieterlen*, 707!

DISTRIBUTION: Cape. Worcester. George. Knysna. Stocken-stroom. Somerset East.

SESUTO: *Khōpa*. Meaning unknown. The roots are burnt and crushed and then boiled; this decoction is drunk to cure colic and also to cure a rash which the natives believe appears on the body after having seen a snake.

**A. medeoloides**, Thunb.

Ravines near rocks or shrubs. A climber, flowers white. Spring. *A. Dieterlen*, 102!; ravine on west slopes of plateau, *Phillips*, 758!

DISTRIBUTION: Namaqualand Minor. Knysna. Bathurst. Albany. Queenstown. Somerset East. Graaff Reinet. Pondoland. East Griqualand. Natal. Transvaal (Houtbosch, Barberton).

SESUTO: *Khōpananyana*. The very small "Khōpa." A lotion is prepared from the roots with which to bathe sore eyes.

KNIPHOFIA, *Moench*.

**K. breviflora**, Harv. (*ex descr.*).

Bester's Vlei, near Witzie's Hoek, December, *Bolus*, 8261!; Natal, Van Reenen's Pass, 5-6000 ft., *Wood*, 5606!

DISTRIBUTION: Probably endemic.

**K. modesta**, Bkr.

Grassy slopes, Glen Airy, District Maclear, c. 5500 ft., *March Galpin*, 6864

DISTRIBUTION: Transkei. Tembuland. East Griqualand. Natal.

**K. fibrosa**, Bkr.

Natal, Mahwaqua Mountain, 6-7000 ft., *Evans*, 649.

DISTRIBUTION: Endemic.

**K. citrina**, Bkr.

Swampy ground, Ben McDhui, 8500-9000 ft., March, flowers flame-coloured. *Galpin*, 6865!

DISTRIBUTION: Albany.

**K. Tysoni**, Bkr.

Mountain slopes, 30-45 in. high, flowers red and yellow. Summer-Autumn. *A. Dieterlen*, 642!

DISTRIBUTION: East Griqualand.

SESUTO: *Lelōlè la lōti*. The "Lelōlè" of the high mountain. *Lelutla*. He who trickles. The natives bathe themselves with a decoction prepared from this plant as a charm against lightning.

**K. Nelsoni**, Mast. (*ex descr.*).

Mountain slopes, 20-32 in. high, flowers red. Spring-Summer. *A. Dieterlen*, 474!; south slopes of plateau, flowers red, *Phillips*, 877!

DISTRIBUTION: Probably endemic.

SESUTO: *Lelōlènyana*. The small "Lelōlè." See note under *K. Tysoni*.

**K. Macowani**, Bkr.

Bester's Vlei, near Witzie's Hoek, 6-6700 ft., December-February, *Bolus*, 8260!, *Flanagan*, 1841!, *Miss Jacobsz in Herb. Bolus*!; grassy slopes at Zaaihoek, Harrismith District, c. 5400-5700 ft., February, flowers orange-scarlet, *Thode*.

DISTRIBUTION: Swellendam. Somerset East. Graaff Reinet.

**K. Thodei**, Bkr.

Slopes of high mountain, Potsane, Leribe District. 8-15 in. high, flowers red. Spring-Summer. *A. Dieterlen*, 872!; grassy slopes of Caledon Range, 7-8000 ft., January-February. Flowers crimson-scarlet. *Thode*, 62!

DISTRIBUTION: Endemic.

SESUTO: *Qalōenyana*. The small "Qalōe."

**K. natalensis**, Bkr. var. *angustifolia*, Bkr.

Natal, Tabanhlope Mountain, 6-7000 ft., *Evans*, 411.

DISTRIBUTION: Endemic.

**K. sarmentosa**, Kunth.

Banks of river and mountain slopes. Flowers red and yellowish. Spring-Summer. *A. Dieterlen*, 174! 174a!; ravines, rare, *Phillips*, 574!



DISTRIBUTION: Endemic?

SESUTO: *Lelolèlè*. *Lelolèlè*. Meanings unknown. A decoction prepared from this species is drunk to cure pains in the shoulders. Women, during the time girls are undergoing the initiation rites, make use of this plant for some purpose, but this being one of the sacred rites of the tribe, no further information could be obtained.

**K. alooides**, Moench.

Basutoland, without precise locality, *Cooper*, 3234!; Bester's Vlei, near Witzie's Hoek, 6000–6300 ft., December. Flowers golden, *Bolus*, 8259!, *Flanagan*, 2050!

DISTRIBUTION: Cape. Uitenhage. Somerset East. Graaff Reinet. Murraysburg. Natal. Transvaal (Barberton).

**K. Northiae**, Bkr.

District Barkly East, swampy ground at Ben McDhui, 8500–9600 ft., March, 3–4 ft. high, *Galpin*, 6866!

DISTRIBUTION: Albany.

**K. Schlechteri**, Schinz.

Natal, Van Reenen, 7000 ft., March, *Schlechter*, 6940!

DISTRIBUTION: Endemic.

**K. multiflora**, W. & E.

Natal, damp places at Van Reenen, 5–6000 ft., March, flowers white with reddish-brown buds, *Wood*, 6684!

DISTRIBUTION: Endemic.

## ALOE, *Lian*.

**A. Kraussii**, Bkr.

Veld and hillsides. 10–25 in. high, flowers yellowish-red. Autumn. *A. Dieterlen*, 419!

DISTRIBUTION: Pondoland. Natal. Swaziland.

SESUTO: *Lekhalana*. The small “Lekhala” (“Lekhala” is a general name for species of *Aloe*). *Hloho tsa makaka*. Heads of the “white-quilled bustards.” *Maroba-lihale*. Those who break gunshots. Young girls undergoing the initiation rites must bathe themselves, on the first night of their entering the initiation school, with a lotion prepared from this species. A decoction of the roots is drunk by barren women so that they may become pregnant. During her pregnancy she must bathe herself with the same decoction, which is also drunk at the confinement and after the birth of the child.

**A. humilis**, Mill. var. *incurva*.

Ravine and mountain slopes. 6-18 in. high, flowers red. Summer.

*A. Dieterlen*, 323!

DISTRIBUTION: Komgha.

SESUTO: *Sereleli*. The slippery one. An uprooted plant is placed on a shelf in the hut of a barren woman; if it flowers under these conditions she will become pregnant, but will remain barren if it withers.

**A. pratensis**, Bkr.

Basutoland, living plant in *Hort. Hanbur*.

DISTRIBUTION: Somerset East.

**A. latifolia**, Haw.

Mountain slopes, 15-20 in. high, flowers red or yellow. Spring (August-October). *A. Dieterlen*, 337!

DISTRIBUTION: Albany. Cathcart. Somerset East. Graaff Reinet. Komgha.

SESUTO: *Lekhala la thaba*. The "Lekhala" of the mountain. The plant is burnt, crushed, and boiled; this mixture, if sprinkled round a village, acts as a charm against lightning. To stamp out an epidemic of cold (influenza?) in a village, all the people must bathe themselves in public with an infusion prepared from the plant. If an animal breaks a limb, the natives place in the ground under the broken limb, the ashes of the burnt leaves. This is supposed to heal the break.

**A. ferox**, Mill.

Mountains at Leloaleng, Quthing District. Flowers red. Common. November. *A. Dieterlen*, 943!

DISTRIBUTION: Graaff Reinet. Komgha. Transkei.

SESUTO: *Hlaba*. To pierce. *Lekhala la Quthing*. The "Lekhala" (aloe) of Quthing. This forms one of the ingredients found in the "Manaka," or horns carried by the witch doctors.

Madame Dieterlen states that in some localities the whole mountain-side is covered with this species.

BULBINE, *Linn.***B. rostrata**, Willd.

Mountain slopes and plateau. 12-25 in. high, flowers yellow. Spring-Summer. *A. Dieterlen*, 449!

DISTRIBUTION: Albert. Graaff Reinet.

SESUTO: *Serehilenyana*. The "small" slippery one. The plant is crushed, dried, and smoked as a cure for a cold in the head.

This is almost exact match with a plant collected by Bolus at Graaff Reinet.

**B. filifolia**, Bkr.

Dry spots on mountain slopes. 15–25 in. high, flowers yellow. Spring. *A. Dieterlen*, 728!

DISTRIBUTION: Port Elizabeth. Somerset East. Graaff Reinet.

SESUTO: *Tšika lilōmō*. He who is going along the cliffs. *Malit-sōane*. Meaning unknown.

**B. caespitosa**, Bkr.

Orange Free State, Caledon River, *Burke*.

DISTRIBUTION: Bechuanaland.

**B. asphodeloides**, R. & S.

Veld and plateau. 10–20 in. high, flowers yellow, strongly scented. Spring. *A. Dieterlen*, 308!; Mont-aux-Sources, 8000 ft., April, *E. Dyke* in *Herb. Marloth*, 5441! in *Herb. Musei Austro-Afric.*, 5519!; Nelson's Kop, *Cooper*, 878.

DISTRIBUTION: S.W. Africa. Namaqualand Minor. Cape. Caledon. Riversdale. Albany. Somerset East. Colesberg. Hanover. Komgha. Tembuland. Natal. Griqualand West. Bechuanaland. Transvaal (near Pretoria).

SESUTO: *Sehlar sa pekana*. A medicine for cracked lips. *Sehlar sa mollo*. A medicine for burns. The leaves are used for healing cracked lips.

**B. narcissifolia**, Salm-Dyck.

Mountain slopes and plateau. 7–20 in. high, flowers yellow. Spring. *A. Dieterlen*, 429!

DISTRIBUTION: Stockenstroom. Somerset East. Khomgha. Natal. Transvaal (Matebe Valley).

SESUTO: *Khomo ea bashemane*. The ox of the young boys. A decoction of the roots is drunk by barren women who wish to become pregnant. Given to cows for the same purpose.

ERIOSPERMUM, *Jacq.*

**E. microphyllum**, Bkr. (*ex descr.*).

Veld and plateau. 2–15 in. high, flowers white. Summer. *A. Dieterlen*, 589!; Natal, Weenen County, 5–6000 ft., *Wood*, 4394.

DISTRIBUTION: Endemic.

**SESUTO:** *Khongoana-tšingoana*. The small cattle of the little fields (an allusion to the size of the plants and to the fact that they grow together—as cattle and sheep feed together). The principal use of this plant is to make dolls for barren women. The crushed roots are burnt and made into a paste with which the native doctors fashion a doll (without legs or arms). This doll is clothed and ornamented with beads and carried on the back as native women carry their children. The women must pretend to suckle it as if it were a child. By observing these customs she hopes to become pregnant. The native name for these dolls is “Ngoan’a Khongoana tšingoana,” meaning the child of “Khongoana-tšingoana.”

**E. natalense**, Bkr.

Natal, in valley near Van Reenen, 5–6000 ft., December, flowers purple with white tips, *Wood*, 5861!

**DISTRIBUTION:** Komgha. Pondoland. East Griqualand. Natal.

**E. dissitiflorum**, Schltr. (*ex descr.*).

Mountain slopes. 20–35 in. high, flowers white and reddish. Spring–Summer. *A. Dieterlen*, 366!; mountains between Bester’s Vlei and Mont-aux-Sources, December, *Flanagan*, 8263!

**DISTRIBUTION:** Queenstown.

**SESUTO:** *Tsèbè ea Khomo*. The ear of an ox. *Lekoto la litsoène*. The “Lekoto” of the monkeys. *Tsèbè ngoe*. One ear.

**E. Cooperi**, Bkr.

Basutoland, without precise locality, *Cooper*, 3307, 3310; Natal, in a valley near Van Reenen’s Pass, 5–6000 ft., *Wood*, 4519.

**DISTRIBUTION:** Endemic.

**E. sp.**

Bester’s Vlei, near Witzie’s Hoek, 5300 ft., December, *Bolus*!

There are no leaves on the specimen.

**ANTHERICUM**, *Linn.*

**A. Cooperi**, Bkr.

Basutoland, without precise locality, *Cooper*, 3302.

**DISTRIBUTION:** Natal (no locality). Probably endemic.

**A. capitatum**, Bkr.

Bester’s Vlei, near Witzie’s Hoek, 5400 ft., December, *Bolus*, 8264!

Natal, in swamp at Van Reenen, 5–6000 ft., December, *Wood*, 5483!, 4795; flowers white, *Wood*, 9640!

**DISTRIBUTION:** Endemic.

**A. pulchellum**, Bkr.

Mountain slopes and plateau. 1-2½ ft. high, flowers white. Summer. *A. Dieterlen*, 271!; flowers white, uncommon, *Phillips*, 543! 918! 964!; Basutoland, without precise locality, *Cooper*, 3300.

DISTRIBUTION: Queenstown. Albert. Transkei. Tembuland. East Griqualand. Natal. Bechuanaland. Orange Free State (Parys).

SESUTO; *Lehau-hau*. *Lehao-hao*. *Lelao-tlao*. Meanings unknown. *Likonyana tsa ngoan'a morena*. The lambs of the chief's child. The roots are eaten by shepherd boys.

**A. elongatum**, Willd. (*ex descr.*).

Mountain slopes, hanging from cliffs. 20-40 in. long, flowers white. Spring. *A. Dieterlen*, 669!

DISTRIBUTION: Cape. Cradock. Carnarvon.

SESUTO: *Lelolènyana la lilòmò*. The small "Lelolè" of the cliffs.

**A. Macowanii**, Bkr.

Banks of streams on veld and mountain slopes. 5-18 in. high, flowers white. November-February. *A. Dieterlen*, 322!; Basutoland, without precise locality, *Cooper*, 747, 3298!

DISTRIBUTION; Albany. Queenstown. Graaff Reinet. Prince Albert. Tembuland. East Griqualand. Bechuanaland. Transvaal (Matebe Valley).

SESUTO: *Motoropo o monyenyane*. The small "Motoropo."

**A. ciliatum**, Linn. fil. (*ex descr.*).

Veld and on banks of streams. 30-40 in. high, flowers white. Spring (September). *A. Dieterlen*, 348!

DISTRIBUTION: Namaqualand Minor. Malmesbury. Cape. Knysna.

SESUTO: *Motoropo*. Meaning unknown.

AGAPANTHUS, *L'Her.*

**A. umbellatus**, *L'Her.*

Natal, Tugela River, *Allison*.

DISTRIBUTION: Uitenhage. Port Elizabeth. Somerset East. Transvaal (Houtbosch, Barberton).

**var. minor.**

Stony spots on mountain slopes. 25-35 in. high, flowers blue.



Summer. *A. Dieterlen*, 385!; ravines, flowers blue, *Phillips*, 639!; Mont-aux-Sources, 8000 ft., April, *E. Dyke in Herb. Marloth!*, in *Herb. Musei Austro-Afric.* 5518!

DISTRIBUTION: Komgha. East Griqualand.

SESUTO: *Leta la phofu*. The thick shiny saliva of the Eland. A lotion made from the crushed roots is used to wash a newly-born child to make it strong.

#### TULBAGHIA, *Linn.*

##### *T. acutiloba*, Harv.

Damp spots on veld. 10–22 in. high, flowers greenish-brown. Spring. *A. Dieterlen*, 376!; Mont-aux-Sources, 8000 ft., January, *Flanagan*, 2048!

DISTRIBUTION: Cape. Stockenstroom. Queenstown. Somerset East. Tembuland. East Griqualand. Natal. Transvaal (Pretoria).

SESUTO: *Motsuntsunyane*. Meaning unknown. The plant in the young state is eaten as a vegetable. A lotion is prepared from the cooked plant with which to wash incisions made on a child and on the breasts of the mother in cases of depressed fontanel in infancy. Madame Dieterlen notes that this plant is devoid, or almost so, of scent.

##### *T. alliacea*, *Linn. f.*

Mountain slopes. 10–25 in. high, flowers dark yellow. Summer. *A. Dieterlen*, 702!

DISTRIBUTION: Malmesbury. Cape. Albany. Uitenhage. Humansdorp. Stockenstroom. King William's Town. Komgha. Natal. Transvaal (Pretoria).

SESUTO: *Moelela*. Meaning unknown.

*T. Dieterlenii*, *Phillips*, sp. nov. *Folia* circiter 7, 10–18 cm. longa, 1–1.5 mm. lata, linearia, apice acuta, basi plana, membranacea, 8 mm. lata, glabra. *Pedunculus* 20–34 cm. longus, 2–3 mm. latus, teres, supra angustatus. *Bracteae* 1.5 cm. longae, 4–4.5 mm. latae, ovatae, acuminatae, apice acutae, membranaceae, glabrae. *Inflorescentia* 4–6-florifera. *Pedicellus* .6–2.5 cm. longus, teres, glaber. *Tubus* perianthii 5 mm. longus, campanulatus, glaber; lobi 5 mm. longi, 3 mm. lati, oblongi, apice acuti, glabri. *Corona* integra, 3 mm. longa; margo undulata. *Stamina* sessilia; superiora coronae aequalia; antherae 2 mm. longae, 1.5 mm. latae, oblongae. *Ovarium* 1.5 mm. longum, 2 mm. latum, suborbiculatum; stylus .5 mm. longus, 1 mm. latus; stigma 1.75 mm. latum, capitatum.

*Rootstock* with many thick roots. *Leaves* about 7 to each peduncle, 10–18 cm. long, 1–1.5 mm. broad, linear, obtuse, expanded into a broad membranous sheath at the base 8 mm. wide, glabrous. *Peduncle* 20–34 cm. long, 2–3 mm. in diameter, terete, gradually narrowing above. *Spathe-valves* 1.5 cm. long, 4–4.5 mm. broad, ovate, long-acuminate, acute, membranous, glabrous. *Flowers* 4–6 in an umbel. *Pedicels* .6–2.5 cm. long, terete, glabrous. *Perianth-tube* 5 mm. long, campanulate, glabrous; lobes 5 mm. long, 3 mm. broad, oblong, obtuse, 3-nerved, glabrous. *Corona* entire, 3 mm. long, with an undulating rim. *Stamens* in 2 rows, sessile; the upper reaching to the rim of the corona; anthers 2 mm. long, 1.5 mm. broad, oblong. *Ovary* 1.5 mm. long, 2 mm. broad, suborbicular in outline; style .5 mm. long, 1 mm. broad; stigma 1.75 mm. broad, capitate.

Leribe, December, *A. Dieterlen*, 361.

DISTRIBUTION: Endemic.

**SESUTO:** *Sefotha-fötha*. That which is smelt from a distance. This is cooked with *Pisosperma capense*, and the decoction is drunk to rid the body of a “snake” which is supposed to have been introduced by the witchcraft of an enemy. Used by some natives to strengthen tobacco. The plant has a very strong smell of garlic and is not eaten as is *T. acutiloba*.

Very closely allied to *T. acutiloba*, Harv., from which it may be distinguished by the obtuse perianth-lobes.

### ALLIUM, *Linn.*

#### **A. dregeanum**, Kunth.

Orange Free State, Caledon River, *Burke*.

DISTRIBUTION: Namaqualand Minor. Malmesbury. Riversdale. Queenstown. Graaff Reinet.

### MASSONIA, *Thunb.*

#### **M. tenella**, Soland.

Barkly East District, Ben McDhui, c. 9500 ft., March, flowers white, *Galpin*, 6868!; Wittebergen, 7–8000 ft., *Drège*, 3509.

DISTRIBUTION: Endemic.

#### **M. Bowkeri**, Bkr.

Damp spots on veld and plateau. 1–3 in. high, flowers pure white. Autumn. *A. Dieterlen*, 724!

DISTRIBUTION: Griqualand West. Orange Free State (no locality).

**SESUTO:** *Lematlana*. The small strong one. In certain illnesses,

the witch doctors consult their divining bones, and if this plant is indicated, it is powdered and placed in incisions made on the body of the patient.

### DRIMIA, Jacq.

#### **D. neriniformis**, Bkr.

Plateau. 10-28 in. high, flowers white. Spring. *A. Dieterlen*, 741!; Bester's Vlei, 6400 ft., December, *Bolus*, 8267!; Natal, in swamp near Van Reenen, 5-6000 ft., November-December, *Wood*, 4794! 5860!

DISTRIBUTION: Pondoland.

SESUTO: *Hlare sa nōkō*. The medicine of the porcupine. The burnt roots are powdered and rubbed into external tumours which have been lanced.

### LITANTHUS, Harv.

#### **L. pusillus**, Harv.

Crevices of rocks on mountain slopes. 2-3½ in. high, flowers white. Summer. *A. Dieterlen*, 855!

DISTRIBUTION: Uitenhage. Swaziland.

SESUTO: *Khoho ea lefika*. The crust of the rock. Together with certain mosses, the plant is burnt and powdered and rubbed into incisions made on the forehead as a cure for headache.

### DIPCADI, Medic.

#### **D. polyphyllum**, Bkr. (*ex descr.*).

Veld and mountain slopes. 3-20 in. high, flowers reddish-brown. Spring. *A. Dieterlen*, 237!

DISTRIBUTION: Natal.

SESUTO: *Morōtoan 'a phookoana*. The urine of the young he-goat. The plant is burnt and powdered and rubbed into incisions made on the thumb and index fingers of a man to give him a sure aim when hunting or fighting. A decoction prepared from the cooked plants is drunk to cure a sexual disease called by the natives "Morōtoana."

#### **D. viride**, Moench.

Veld and mountain slopes. 7-25 in. high, flowers green. Spring-Summer. *A. Dieterlen*, 259!; Caledon River, *Burke*.

DISTRIBUTION: Riversdale. Uitenhage. Somerset East. Graaff Reinet. Albert. Pondoland. Natal. Griqualand West. Transvaal (Barberton).

SESUTO: *Morōtoan 'a phookoana*. The urine of the young he-goat. *Thelelimōrō* or *Thebelimōrō*. The juicy knee-cap. The plant is much esteemed by the natives as a vegetable.

See also notes under *D. polyphyllum*.

**D. cf. D. umbonatum**, Bkr.

Malavaneng, Leribe District. Flowers green. November. *A. Dieterlen*, 954!

SESUTO: *Morōtoan 'a phookoana*. The urine of the young he-goat. See notes under *D. polyphyllum*.

The material is too poor for determination.

**D. sp.**

Mountain slopes near ravine. Flowers yellowish-brown. November. *A. Dieterlen*, 1009!

SESUTO: *Morōtoan 'a phookoana*. The urine of the young he-goat. See note under *D. polyphyllum*.

The material is too poor for a more precise determination.

GALTONIA, *Dcne.*

**G. candicans**, *Dcne.*

On the Wittebergen Range, 7–8000 ft., *Drège*, 3529; Orange Free State, near Nelson's Kop, *Cooper*, 3285; Natal, on the Drakensbergen, 6–7000 ft., *Evans*, 360; sources of the Tugela River, *M'Ken*, 5, *Allison*; Oliver's Hoek Pass, *Wood*, 3498.

DISTRIBUTION: Endemic.

**G. princeps**, *Dcne. (ex descr.)*.

Slopes of the Mont-aux-Sources, 7–8000 ft., January, *Flanagan*, 1825!

DISTRIBUTION: Transkei. Tembuland. Pondoland. Natal. Zululand.

ALBUCA, *Linn.*

**A. major**, *Linn.*

Mountain slopes. 20–30 in. high, flowers white and green. Spring (September). *A. Dieterlen*, 299!

DISTRIBUTION: Cape.

SESUTO: *Motōtse*. Meaning unknown. A highly esteemed plant with the natives for making charms. As a protection against harm, parts of the plant are rubbed into incisions made on the body.

**A. Cooperi**, Bkr.

Banks of streams and on mountain slopes. 4-15 in. high, flowers white and green. Spring (September-October). *A. Dieterlen*, 204!

DISTRIBUTION: Cape.

SESUTO: *Nkonko-phiri*. The "Nkonko" of the wolf. *Sua-lilale*. Let the cause of the quarrel rest. Used as a charm to pacify an enemy; this is done by sprinkling a lotion prepared from the plant at some place where one of the parties of the quarrel will pass. Also a protective charm against lightning. A lotion is prepared with which to wash wounds in animals.

**A. trichophylla**, Bkr.

Shady spots on mountain slopes. 8-22 in. high, flowers yellow, leaves sweetly scented. Summer. *A. Dieterlen*, 672!; Natal, stony slopes of Drakensberg, 4 5000 ft., January, flowers yellow, *Wood*, 3445!

DISTRIBUTION: Orange Free State (no locality). Transvaal (Carolina, Lake Chrissie).

SESUTO: *Morotoan 'a phookoana*. The urine of the young he-goat. See note under *Dipcadi polyphyllum*.

**A. minima**, Bkr.

Stony grassy places on summit of Quaqua Mountain, c. 6900 ft., January, flowers yellow. *Thode*, 61!

DISTRIBUTION: Endemic.

**A. viridiflora**, Jacq. (*ex descr.*).

Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*, 8262!

DISTRIBUTION: King William's Town.

**A. humilis**, Bkr.

Natal, wet rocks at the top of Tabanhllope Mountain, 6600 ft., *Evans*, 361.

DISTRIBUTION: Endemic.

URGINEA, *Strinh.***U. tenella**, Bkr. (*ex descr.*).

Mountain slopes, crevices of rocks. 1½-5 in. high, flowers white. Spring. *A. Dieterlen*, 656!; Natal, Van Reenen's Pass, in crevices of rocks, 5000 ft., *Wood*, 4562.

DISTRIBUTION: Endemic.



SESUTO: *Lepshetlane le lenyenyane*. The small "Lepohetlane." *Khoho ea lefika*. The crust of the rock.

**U. capitata**, Bkr.

Mountain slopes. 10-20 in. high, flowers white. Spring. *A. Dieterlen*, 363!

DISTRIBUTION: Komgha. East Griqualand. Transvaal (Barborton).

SESUTO: *Moretele*. He who causes to glide or slip. Of all the Basutoland plants, this is perhaps the most esteemed by native doctors, who prepare from it a powerful charm able to bring good fortune to friends or inflict harm on enemies. By the use of this charm the natives believe that they can "glide" among their enemies unnoticed and unharmed. By its use, sorcerers are kept away from huts, illness and death can be sent to enemies, and the country can be made to flourish or otherwise. Basuto chiefs are vaccinated with it.

**U. rubella**, Bkr.

Damp spots on mountain slopes. 6-20 in. high, flowers white. Spring. *A. Dieterlen*, 404! 649!

DISTRIBUTION: Natal.

SESUTO: *Khoho ea thaba* (649). The crust of the mountain. *Metsane* (404). Little water (in the juicy bulb). *Qobo la poli* (404). The penis of a goat. A decoction made from the bulbs is drunk for curing colic.

*Dieterlen*, 649, is an exact match with *Wood*, 5720, the type of the species. *Dieterlen*, 404, is a form with longer leaves.

**U. macrantha**, Phillips, comb. nov. *Folia*  $1\frac{1}{2}$ -2 ped. longa, linearia, glabra (ex *Baker*). *Inflorescentia* racemosa, 30-48 cm. longa, laxa 20-40-florifera. *Pedunculus* 1-2 m. longus, glaber. *Bracteae* .7 mm. longae, 4 mm. latae, acuminatae, basi saccatae, glabrae, caducae; bracteolae 1, 2.5 mm. longae, circiter 1 mm. latae, concavae. *Pedicellus* ad 6.2 cm. longus, teres, glaber. *Segmenta* perianthii basi adnata, 2.7-3.7 cm. longa, 4 mm. lata, linearia, apice obtusa glandulosaque, glabra. *Filamenta* 1.5 cm. longa, basi 2 mm. lata et plana, supra lanceolata; antherae 4.5 mm. longae, ovato-oblongae, apice obtusae, basi sagittatae. *Ovarium* 6.5 mm. longum, 3.5 mm. latum, ovatum; stylus 1.6 cm. longus, apice planus; stigma 3.5 mm. latum, tri-lobatum.

*Bulb* large, scaly. *Leaves* hysteranthous,  $1\frac{1}{2}$ -2 ft. long, linear,

glabrous (ex *Baker*). *Inflorescence* racemose, 30–48 cm. long, laxly 20–40-flowered. *Peduncle* 3–6 ft. long, glabrous. *Bracts* .7 mm. long, 4 mm. broad, boat-shaped, keeled, acuminate, with a short blunt conical spur at the base, membranous, not spotted with dark markings, caducous; bracteole 1, 2.5 mm. long, about 1 mm. broad, deeply concave. *Pedicels* up to 6.2 cm. long in adult flowers, terete, glabrous. *Buds*, just before opening, 2.5–3 cm. long, 6–8 mm. broad above, usually somewhat globose at the base, but cylindric above. *Perianth-segments* cohering at the very base (not truly polyphyllous), 2.7–3.7 cm. long, 4 mm. broad, linear, obtuse, glandular at the apex, glabrous, with a broad band .6 mm. wide running the length of the mid-rib. *Stamens* 1.5 cm. long, inserted at the base of the perianth-segments; filaments 1.5 cm. long, 2 mm. broad below, flattened, narrowed above the middle, then lanceolate; anthers 4.5 mm. long, ovate-oblong in outline, obtuse, bluntly sagittate at the base. *Ovary* 6.5 mm. long, 3.5 mm. broad below, ovate in outline; style 1.6 cm. long, widened at the apex into a stigma; stigma 3.5 mm. across the top, divided into three flat lobes 1.75–2 mm. long, 2–3.5 mm. broad; the broadest lobe semiorbicular; the smaller lobes each forming  $\frac{1}{4}$  of a circle.

Damp valleys near the Kei Mouth. Peduncle rising to 4 or 5 ft. from a leafless scaly bulb, flowers reddish, 1500 ft., November, *Flanagan*, 468; Transkei, Kentani, valleys; 3–4 ft. high, erect, leafless; glossy rich brown raceme, petals thrown back; occasional; 1000 ft., November, *A. Pegler*, 79.

*Baker* first described this plant as *Ornithogalum*? *macranthum* (*Journ. Linn. Soc.*, xiii, 280), and then changed the name to *Drimia macranthum* (*Engler's Jahrb.*, xv, Heft iii, 7). In the "*Flora Capensis*" the latter name stands, but the genus is queried.

The flattened filaments and deciduous bracts would remove this plant from the genus *Drimia*, while the deciduous bracts and flattened seeds would also remove it from *Ornithogalum*.

The deciduous perianth, the single-nerved keel, the insertion of the filaments at the base of the perianth-segments, the discoid seeds (seen in *U. basutica*), and spurred bracts all point to the plant being an *Urginea*.

I have inserted the description in this paper so as to compare with it *U. basutica*.

**U. basutica**, Phillips, sp. nov. *Folia* 36–52 cm. longa, .8–1.3 cm. lata, linearia, acuminata, apice obtusa, glabra. *Inflorescentia* ad 27 cm. longa, laxe 12–18-florifera. *Pedunculus* 35–40 cm. longus,

glaber. *Bracteae* .7-1 cm. longae, 3-4 cm. latae, acuminatae, basi saccatae, glabrae, deciduae; *bracteolae* 1, 4 mm. longae, 1.5-2 latae. *Pedicellus* ad 7 cm. longus, teres, glaber. *Segmenta* perianthii basi adnata, 2 cm. longa, 3.5-4 mm. lata, lineari-oblonga, apice obtusa glandulosaque, glabra. *Filamenta* 9 mm. longa, basi 1.75 mm. lata planaue, supra lanceolata, acuminata; *antherae* 4 mm. longae, oblongae, basi sagittatae. *Ovarium* 5 mm. longum, 2 mm. latum, oblongum; *stylus* 7 mm. longus, apice planus; *stigma* 2 mm. latum, paullo tri-lobatum. *Fructus* 3.5 cm. longus, 1.6 mm. latus, ellipsoideus, glaber. *Semina* 7 mm. longa, 5 mm. lata, plana, alata: testa nigra.

*Bulb* not seen. *Leaves* contemporary with the flowers, 36-52 cm. long, .8-1.3 cm. broad, linear, acuminate near the tip, obtuse, glabrous. *Inflorescence* racemose, about 27 cm. long, laxly 12-18-flowered. *Peduncle* 35-40 cm. long, glabrous. *Bracts* .7-1 cm. long, 3-4 mm. broad, boat shaped, keeled, acuminate, glabrous, with a blunt conical spur at the base, membranous, dotted with dark markings, deciduous; *bracteole* 1, 4 mm. long, 1.5-2 mm. broad, otherwise similar to the bract. *Pedicels* 1 cm. long in young flowers, up to 7 cm. long in adult flowers, terete, glabrous. *Buds*, just before opening, 1 cm. long, 4 mm. broad above, 3 mm. broad below, cylindric in the lower half, campanulate in the upper. *Perianth-segments* cohering at the very base (not truly polyphyllous), 2 cm. long, 3.5-4 mm. broad, linear, oblong, obtuse, glandular at the apex, glabrous, with a broad band .6 mm. wide running the length of the mid-rib. *Stamens* 9 mm. long, inserted at the base of the perianth-segments: *filaments* 9 mm. long, 1.75 mm. broad below, flattened, constricted at the middle, lanceolate and acuminate in the upper half; *anthers* 4 mm. long, oblong, bluntly sagittate at the base. *Ovary* 5 mm. long, 2 mm. broad, oblong in outline; *style* 7 mm. long, widened at the apex into a stigma; *stigma* 2 mm. across the top, obsoletely 3-lobed. *Capsule* 3.5 cm. long 1.6 cm. broad, ellipsoid, glabrous, with loculicidal dehiscence. *Seeds* 7 mm. long, 5 mm. broad, discoid, winged; testa black.

Mountain slopes. 15-36 in. high, flowers greenish-yellow. Spring (October-November), Mavana-Masovana, Leribe District, *A. Dieterlen*, 854.

DISTRIBUTION: Endemic.

SESUTO: Moretele o moholo. The "big one" who causes to glide. See note under *U. capitata*.

Near *U. macrantha*, Phillips, but differs in having spotted bracts, smaller flowers, and differently shaped filaments and stigma. The leaves are also contemporary with the flowers.

## EUCOMIS, L'Her.

*E. bicolor*, Bkr.

Damp spots on mountain slopes. 12–25 in. high. Flowers white and violet, badly scented. Summer–Autumn. *A. Dieterlen*, 505!; near “Cave” at the foot of the Mont-aux-Sources, 6200 ft., December, *P'lanagan*, 1829!; Natal, Tugela River, Allison, 23; valleys of the Drakensbergen, in swamps, 6–7000 ft., *Evans*, 396.

DISTRIBUTION: East Griqualand.

SESUTO: *Khapumpu ea thaba*. The “Khapumpu” of the mountain. A medicine for colic.

*E. humilis*, Bkr.

Natal, summit of Tabanhlope Mtn. 6–7000 ft., *Evans*, 398.

DISTRIBUTION: Endemic.

*E. undulata*, Ait.

Veld and mountain slopes. 10–20 in. high, flowers green. Summer–Autumn. *A. Dieterlen*, 227!; under rocks, flowers green, frequent, *Phillips*, 549!; foot of mountains at Bester's Vlei, 5500 ft., December, *Bolus*, 8268!

DISTRIBUTION: Uitenhage. Somerset East. Graaff Reinet. Colesberg. Transkei. Tembuland. Natal. Orange Free State (Modder River Drift, Bloemfontein). Transvaal (Rustenburg, Johannesburg).

SESUTO: *Khapumpu*. Powerful charms are prepared from this species, used in a similar way to those of *Urgenia capitata*.

*E. amaryllidifolia*, Bkr.

Orange Free State, Caledon River, *Burke*; Natal, Giant's Castle, 7000 ft., November, flowers white. *A. Bolus in Herb. Bolus*, 4940!

DISTRIBUTION: Endemic.

## SCILLA, Linn.

*S. rigidifolia*, Kunth.

Wittebergen, 5–6000 ft., *Drège*, 4506 c.

DISTRIBUTION: King William's Town. Tembuland. East Griqualand. Natal. Transvaal (Aapie's River, Barberton).

var. *nervosa*, Bkr.

Orange Free State, near Nelson's Kop, *Cooper*, 882.

DISTRIBUTION: Natal. Griqualand West. Bechuanaland.

var. *Gerrardi*, Bkr.

Mountain slopes and plateau. 8–15 in. high, flowers white.

Summer. *A. Dieterlen*, 231!; stony places on summit of Quaqua Mountain, c. 6900 ft., January. Flowers whitish, *Thode* 60!; hill above Bester's Vlei, near Witzie's Hoek, 6750 ft., December, *Flanagan*, 1837!

DISTRIBUTION: Albany. King William's Town. Tembuland. Natal. Orange Free State (no locality).

SESUTO: *Lenaka la khomo*. The horn of the cattle. *Sebōka*. An assembly (the plant grows in patches). The bulb is crushed and mixed with the food of a child suffering with constipation.

**S. natalensis**, Planch.

Growing on cliffs in ravines and mountain slopes. 15–28 in. high, flowers blue. Spring (September–October). *A. Dieterlen*, 416!

DISTRIBUTION: Komgha. Tembuland. Natal. Orange Free State (no locality). Transvaal (Barberton).

SESUTO: *Khèrèrè*. Meaning unknown. A medicine given to cattle suffering with lung sickness. The cooked bulbs are mixed with food as an aperient. For internal tumours a decoction made from the well-cooked bulbs is taken as an enema.

**S. inandensis**, Bkr.

Mountain and hill slopes. 3–8 in. high, flowers greenish-violet, leaves entirely light green on both sides. Summer. *A. Dieterlen*, 662!

DISTRIBUTION: Natal.

SESUTO: *Beokho*. Meaning unknown. A preparation is made from this plant and given to women in the fourth month of pregnancy to soothe them. Given to cows with the idea of being able to have a succession in the sexes of the calves born.

The leaves are narrower than in the type.

**S. Cooperi**, Hook. fil.

Mountain slopes. 2–10 in. high, flowers violet, leaves with purplish marks beneath. Summer. *A. Dieterlen*, 57a!

DISTRIBUTION: Orange Free State (no locality).

SESUTO: *Phetōla*. Derived from the verb “ho fetōla”- to turn over—to change—to modify. See note under *S. inandensis*.

**S. Galpini**, Bkr.

Mountain slopes. 3–6 in. high, flowers violet, leaves entirely purple beneath. Summer. *A. Dieterlen*, 57c!

DISTRIBUTION: Transvaal (Barberton).

SESUTO: *Phetōla*. See *S. Cooperi*, and also under *S. inandensis*.



**S. lancaefolia**, Bkr.

Veld and mountain slopes. 4-15 in. high, flowers violet. Early Spring. *A. Dieterlen*, 228!; Bester's Vlei, near Witzie's Hoek, 6400 ft., December, *Bolus*!

DISTRIBUTION: Cape. George. Albany. Somerset East. Aliwal North. Natal. Orange Free State (no locality). Transvaal (Rustenburg, Aapie's River, Mac Mac, near Pretoria, Barberton). Bechuana-land.

SESUTO: *Bookhoè*. *Boakhoè*. Meanings unknown. The split leaves are woven into ropes used to sew together mats made with various *Cyperaceae*. A charm to drive away lightning. As a cure for lumbago the following remedy is applied: The patient lies on his stomach, the native doctor puts his right foot into a bowl of water which has been boiled with some of the bulbs, he then places his foot on the iron portion of a red-hot hoe for a few seconds and rubs the small of the patient's back with the sole. This is repeated until relief is obtained. Pregnant women are not allowed to undergo this treatment.

**S. cf. S. humifusa**, Bkr.

Drakensberg, 7000 ft., November, flowers mauve. *A. Bolus in Herb. Guthrie*, 4936!

The pedicels are up to 2 cm. long.

**S. sp.**

Mountain slopes, 3-6 in. high, flowers violet, leaves spotted. Summer. *A. Dieterlen*, 57b.

SESUTO: *Phetōla*. See also *S. Cooperi*, and also note under *S. inandensis*.

The material is too poor for a precise determination.

ORNITHOGALUM, *Linn.***O. diphyllum**, Bkr.

Natal, in swamps at summit of Tabanhlope Mountain, 6-7000 ft., *Evans*, 374!

DISTRIBUTION: Endemic.

**O. Flanaganii**, Bkr.

Summit of Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2028!

DISTRIBUTION: Endemic.

**O. gracilentum**, Bkr.

Bester's Vlei, near Witzie's Hoek, 6000 ft., December, *Flanagan*, 1893!

DISTRIBUTION: Somerset East. Griqualand East.

**O. Zeyheri**, Bkr.

Natal, in marsh at Van Reenen, 5-6000 ft., December, flowers white, *Wood*, 4532!; Caledon River, *Burke*.

DISTRIBUTION: Namaqualand Minor. Uitenhage. Alexandria. Albany. Graaff Reinet. Albert. Transvaal (Hooge Veld, Bosch Veld, Middleburg). Orange Free State (Parys).

**O. natalense**, Bkr.

Natal, summit of Amawahqua Mountain, 6800 ft., *Wood*, 4567.

DISTRIBUTION: Endemic.

**O. flavovirens**, Bkr.

Natal, Giant's Castle, 6000 ft., November, flowers white. *A. Bolus* in *Herb. Guthrie*!

DISTRIBUTION: Somerset East. Aliwal North. Komgha. Transkei. Tembuland.

**O. oliganthum**, Bkr. (*ex descr.*).

Mountain slopes and plateau 3-20 in. high, flowers white. Spring-Summer (November). Leribe, and at Makaveneng, Leribe District. *A. Dieterlen*, 651! 971!

DISTRIBUTION: Natal.

SESUTO: *Liyo tsa nōkō*. The food of the porcupine.

The leaves are 1 ft. long, i.e. longer than in the type.

**O. graminifolium**, Thunb.

Damp spots on mountain slopes. 10-25 in. high, flowers white. Spring. *A. Dieterlen*, 729!

DISTRIBUTION: Cape. Paarl. Tulbagh. Murraysburg. Komgha. Natal.

SESUTO: *Metsane a manyenyane*. Meaning unknown. *Nko ea ntja*. The nose of a dog.

**O. Eckloni**, Schltr.

Mountain slopes. 10-20 in. high, flowers greenish white. Summer. *A. Dieterlen*, 420!

DISTRIBUTION: British Kaffraria. Somerset East. Tembuland. East Griqualand. Natal. Griqualand West. Transvaal (Aapie's River, Barberton).

SESUTO: *Moretele o monyenyane*. The "small one" who causes to glide. Used as *Urginea capitata* but not such a powerful charm. By means of this charm an enemy can cause one's cows to miscarry, or dry up the milk of a suckling cow.

**O. capillaris**, Wood and Evans.

Between rocks, Bester's Vlei, near Witzie's Hoek, 5400 ft., January, *Bolus*, 8261!

DISTRIBUTION: Transkei. Natal (Newcastle).

ANDROCYMBIUM, Willd.

**A. melanthioides**, Willd.

Plateau. 3-10 in. long, flowers white. Summer. *A. Dieterlen*, 659!; Natal, under the Drakensberg, *Keit*, 6.

DISTRIBUTION: Worcester (Matjesfontein). Albany. Somerset East. Murraysburg. Victoria East. Graaff Reinet. Swaziland. Transvaal (Barberton, Rustenburg, Houtbosch, Johannesburg, Lydenburg). Griqualand West.

SESUTO: *Khukhoana e nyenyane*. The tiny "Khukhu" (bulb). Mixed with *Polygala* spp. it is used in the cure of many diseases.

**A. leucanthum**, Willd.

Basutoland, without precise locality, *Cooper*.

DISTRIBUTION: Namaqualand Minor. Cape. Knysna. Uitenhage.

**A. natalense**, Bkr.

Summit of the Mont-aux-Sources, 9800 ft., January, *Flanagan*, 2026!

DISTRIBUTION: Natal.

**A. longipes**, Bkr.

Veld and mountain slopes. 6-14 in. high, flowers mauve-pink. Autumn. *A. Dieterlen*, 516!

DISTRIBUTION: Albany. Murraysburg. Somerset East. Komgha.

SESUTO: *Khukhoana*. The small "Khukhu." The dried bulbs are crushed and mixed with fat as an ointment for sore ears.

WURMBEA, Thunb.

**W. capensis**, Thunb.

Wittebergen, 7-8000 ft., *Drège*, 3512; Ben McDhui, District Barkly East, c. 9800 ft., March, *Galpin*, 6870!

DISTRIBUTION: Malmesbury. Cape. Riversdale. Queenstown. Stutterheim. Somerset East. Graaff Reinet. East Griqualand.

**W. Kraussii**, Bkr.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2027!; Natal, Van Reenen, 5-6000 ft., February, flowers greenish-white. *Wood*, 9617!

DISTRIBUTION: Tembuland. Pondoland. East Griqualand.

**W. pusilla**, Phillips, sp. nov. *Planta* pusilla, ad 8 cm. alta. *Folia* 2, 2-4.1 cm. longa, 3-8 mm. lata, ovata vel linearia, acuminata, glabra. *Inflorescentia* spicata, 2-4-florifera, 1.5-2 cm. longa. *Tubus* perianthii 7.5-8 mm. longus, 2-2.5 mm. latus, glaber; lobi 7.5-8 mm. longi, 1.75 mm. lati, lineari-lanceolati, apice obtusi. *Filamenta* 3 mm. longa, glabra; antherae 1 mm. longae, oblongae. *Ovarium* 4.5 mm. longum, 2.5 mm. latum, oblongum, glabrum; stylus 5.5 mm. longus, basi .75-1 mm. latus, apice subulatus; stigma minutum.

A small plant up to 8 cm. long. *Corm* not seen. Produced leaves 2, 2-4.1 cm. long, 3-8 mm. broad, ovate or linear, acuminate, clasping the stem, glabrous; leaf-sheath 7-9 mm. long in the lower leaf, 1.8-2 cm. long in the upper. *Inflorescence* spicate, 2-4-flowered, 1.5-2 cm. long. *Tube* of the perianth 7.5-8 mm. long, 2-2.5 mm. broad, glabrous; lobes 7.5-8 mm. long, 1.75 mm. broad, linear-lanceolate, obtuse, with two dark glandular swellings 2 mm. from the base, glabrous. *Stamens* inserted at the base of the perianth-segments; filaments 3 mm. long, linear glabrous; anthers 1 mm. long, oblong. *Ovary* 4.5 mm. long, 2.5 mm. broad, oblong in outline, glabrous; styles 3, 5.5 mm. long, .75-1 mm. broad at the base, tapering gradually to a subulate apex; stigmas minute.

Mont-aux-Sources, 10000 ft., October, flowers pale, *A. Bolus in Herb. Guthrie*, 4937.

Differs from *W. capensis*, Thunb., in the dwarf habit and the short 1-4-flowered inflorescence, sheathed in the upper leaf.

LITTONIA, *Hook.***L. modesta**, *Hook.*

Damp places at Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*, 8265!; Nelson's Kop, *Cooper*, 880.

DISTRIBUTION: Pondoland. Natal. Transvaal (Barberton, Lydenburg, Belfast).

## XYRIDEAE.

XYRIS, *Linn.***X. capensis**, Thunb.

Marshy places at Leribe, *A. Dieterlen*, 602!; damp ground near stream on plateau, flowers yellow, *Phillips*, 718!

DISTRIBUTION: Cape. Tulbagh. Ceres. Queenstown. Somerset East. Tembuland. Natal. Transvaal (Maçaliesberg, Rustenberg).

## COMMELINACEAE.

### COMMELINA, Linn.

#### *C. benghalensis*, Linn.

Shaded and sheltered spots on veld and mountain slopes. A creeper, 10-40 in long, flowers mauve or blue. Summer. *A. Dieterlen*, 550! 551!; a creeper, flowers blue, *Phillips*, 847! 912!

DISTRIBUTION: Knysna. Uitenhage. Port Elizabeth. Fort Beaufort. Beaufort West. Somerset East. Komgha. Tembuland. Pondoland. Natal. Griqualand West. Transvaal (Warm Baths).

SESUTO: *Khotsoana*. The crooked thing. This plant is largely used by the witch-doctors for various illnesses. A medicine taken by barren women is prepared from it.

#### *C. africana*, Linn.

Veld, mountain slopes, and plateau. 6-18 in. high, flowers yellow. Summer. *A. Dieterlen*, 105!; a creeper, flowers yellow, *Phillips*, 532! 659! 884!; Bester's Vlei, near Witzie's Hoek, 5300 ft., December, *Bolus*, 8291!; Natal, Cathkin Peak, 10000 ft., November, *A. Bolus in Herb. Guthrie*!

DISTRIBUTION: Cape. Uitenhage. Natal. Swaziland. Transvaal (Hooge Veld).

SESUTO: *Khotsoana*. The crooked thing. *Khopo e nyenyane*. The small crooked thing. *Lekhopshoana*. He who is a little crooked. This plant is boiled with *Tephrosia capensis* and the decoction is drunk as a cure for a weak heart or nervousness.

### CYANOTIS, D. Don.

#### *C. nodiflora*, Kunth.

Mountain slopes. 4-20 in. high, flowers white and sky blue. Summer. *A. Dieterlen*, 320a! 320b!; flowers white, rare. *Phillips*, 519!; Basutoland, without precise locality, *Cooper*, 3326.

DISTRIBUTION: Riversdale. Knysna. Uitenhage. Bathurst. Albany. Somerset East. Komgha. Tembuland. East Griqualand. Natal.

SESUTO: *Khopo*. Crooked. *Theepe Balingoana*. The "Theepe" (*Amaranthus* spp.) of the little cannibals. See note under *Commelina benghalensis* and *C. africana*.



# JUNCACEAE.

## JUNCUS, Linn.

### *J. glaucus*, Ehrh. var. *acutissimus*, Buchen.

Damp spots, near water-courses. 20–35 in. high, spikes greyish-brown. Autumn. *A. Dieterlen*, 217!

DISTRIBUTION: Queenstown. Albert. Orange Free State (near Winburg).

SESUTO: *Rororo*. Meaning unknown. This is the common name for all members of the *Juncaceae* and for some of the *Cyperaceae*. *Lehlaka Kolôbe*, The reed of the wild pig. *Lelu-la-lihohoana*. The small frog's chin. Used for making ropes for sewing the large grain baskets ("lisin").

### *J. punctorius*, Linn. f.

Leribe. *A. Dieterlen*, 685b!

DISTRIBUTION: Clanwilliam. Cape. Tulbagh. Worcester. Stellenbosch. Uitenhage. Aberdeen. Somerset East. Pondoland. Griqualand West. Transvaal (Wonderboompoort).

SESUTO: *Rororoana*. Meaning unknown.

### *J. oxycarpus*, E. Mey.

River banks. 10–25 in. high, spikelets brown. Summer. *A. Dieterlen*, 767! 767a! 767b!; near stream in ravine, *Phillips*!

DISTRIBUTION: Cape. Paarl. Worcester. Caledon. Riversdale. Uitenhage. Natal.

SESUTO: *Rororoana*.

### *J. exsertus*, Buchen.

Damp spots on mountain slopes. 10–22 in. high, spikelets brownish. Summer. *A. Dieterlen*, 685a!

DISTRIBUTION: Worcester. Somerset East. Graaff Reinet. Orange Free State (Bloemfontein). Transvaal (Trigard's Fontein, Pretoria, Yster Spruit).

SESUTO: *Rororoana*. *Lebane-le-metsi*. He who faces the water. Used to plait hats.

### *J. cephalotes*, Thunb.

Water-courses. 3–15 in. high, spikelets brownish. Spring-Summer. *A. Dieterlen*, 396!

DISTRIBUTION: Cape.

SESUTO: *Sebokana*. The small assembly. *Rororo e nyenyane*. The small "Rororo."

**J. dregeanus**, Kunth.

Mountain slopes. Spikelets brown. Summer. *A. Dieterlen*, 748b!

DISTRIBUTION: Humansdorp. Uitenhage. Bathurst. Transvaal (Houtbosch).

SESUTO: *Rororoana*.

**J. capitatus**, Weig.

Mountain slopes and plateau.  $\frac{1}{2}$ –4 in. high, spikelets green and pinkish. October–November. *A. Dieterlen*, 806!

DISTRIBUTION: Tropical Africa.

SESUTO: *Rororo e nyenyane*. The small "Rororo."

LUZULA, *D.C.***L. africana**, Drège.

Damp spots on mountain slopes. 6–15 in. high, spikelets brownish. Spring. *A. Dieterlen*, 734!; Mont-aux-Sources, 9500 ft.; *Flanagan*, 2008.

DISTRIBUTION: Stockenström.

SESUTO: *Phororoana*. The small water-fall,

## AROIDEAE.

RICHARDIA, *Kunth*.\***R. albomaculata**, Hook.

Damp shady spots on mountain slopes. 15–40 in. high. Summer. *A. Dieterlen*, 306!; under rocks, spathe green without, white within, common, *Phillips*, 550! 609!; Orange Free State, Ladybrand, November, *Rogers*, 1035!; Wittebergen, 5–6000 ft., *Drège*.

DISTRIBUTION: Komgha. Transkei. Tembuland. East Griqualand, Swaziland.

SESUTO: *Mohalalitoë*. Meaning unknown. In cases of any very severe illness the natives use this species in the following manner: The rhizomes (for preference) are incinerated on a piece of red-hot iron (e.g. a hoe) and the charred remains are rubbed on the patient's body. This is evidently a last resort in cases which are considered hopeless, as the native doctors say the patient either recovers or dies.

**R. hastata**, Hook. f.

Basutoland, without precise locality, *Cooper*, 3327.

DISTRIBUTION: Natal. Transvaal (near Barberton).

\* I have followed the 'Flora Capensis' in the nomenclature.

**R. africana**, Kunth.

Damp spots on mountain slopes. 2-4 ft. high, spathe white. Summer. *A. Dieterlen*, 583!

DISTRIBUTION: Cape. Riversdale. Komgha. Natal.

SESUTO: *Mothèbè*. Meaning unknown. In spring the young leaves and petioles are cooked and eaten as a vegetable. This species is not used as is stated above for *R. albomaculata*.

NAIADACEAE.

APONOGETON, *Thunb.*

**A. spathaceum**, Hook. fil.

Summit of the Mont-aux-Sources, 9500 ft., January, *Flanagan*, 2025!; Natal, Giant's Castle, 7500 ft., November, flowers white. *A. Bolus in Herb. Guthrie*, 4942!

DISTRIBUTION: Port Elizabeth. Transkei. Tembuland East Griqualand. Transvaal (East Rand).

var. **junceum**, Hook. fil.

Basutoland, without precise locality, *Bowker*.

DISTRIBUTION: Uitenhage. Somerset East. Tembuland, Natal. Transvaal (Trigard's Fontein).

POTAMOGETON, *Linn.*

**P. natans**, Linn.

Ponds and marshes. Flowers yellowish. Summer (December). Hlotse. *A. Dieterlen*, 831!

DISTRIBUTION: Natal. Transvaal (sources of Limpopo).

SESUTO: *Sesesi*. The swimmer. *Ntlo ea hlapi*. The house of the fish.

**P. pusillum**, Linn.

In the river Hlotse. Flowers white. Spring (October). Makokoane. Leribe District, *A. Dieterlen*, 1033!

DISTRIBUTION: Cape. Swellendam. Albany. East London, Tembuland. Natal. Zululand. Transvaal (near Pretoria).

SESUTO: *Bolilè*. Water moss. *Joang ba metsi bo boholo*. The large water-grass. *Ntlo ea lihlapì*. The house of the fish.

ERIOCAULEAE.

ERIOCAULON, *Linn.*

**E. abyssinicum**, Hochst.

Water-courses on plateau. 1-2 in. high. Flowers greyish. *A. Dieterlen*, 777!

DISTRIBUTION: Somerset East. Natal.

SESUTO: *Se-ea-le-metsi*. He goes with the water.

**E. Bauri**, N. E. Br.

Harrismith, March, Penther, 40!; Bester's Vlei, near Witzie's Hoek, 5800-6700 ft., December, *Bolus*, 8269!, *Flanagan*, 1863!

DISTRIBUTION: Tembuland c. 4000 ft.

**E. sp.**

Damp spots on top of Quaqua Mountain, Witzie's Hoek, c. 6900 ft., *Thode*!

DISTRIBUTION: Endemic.

Near *E. Bauri*, N. E. Br., but differs in the thinner texture of the leaves and the smaller heads. It is probably an undescribed species, but the material I have seen is immature.

RESTIACEAE.

RESTIO, *Linn.*

**R. schoenoides**, Kunth.

Stony places on mountain slopes 12-25 in. high, spikelets brown. Summer. *A. Dieterlen*, 192!; Witte Bergen, 5-6000 ft., *Drège*, 50.

DISTRIBUTION: Endemic.

SESUTO: *Moficelo oa thaba*. The broom of the mountain. *Leficeloana*. The small broom. Used for making brooms.

CYPERACEAE.

KYLLINGA, *Rottb.*

**K. alba**, Nees.

Veld and mountain slopes. 3-20 in. high, spikelets white. Summer. *A. Dieterlen*, 334!; Caledon River, *Burke*, 202; Basutoland, without precise locality, *Cooper*, 919.

DISTRIBUTION: Namaqualand Minor. Queenstown. Komgha. Natal. Griqualand West. Transvaal (Crocodile River, Houtbosch, Magaliesberg).

SESUTO: *Tsoane*. The diminutive form of "Motaoataone," a common name for the *Cyperaceae*. Meaning unknown. *Monokostoai oa litsöene*. The mulberry of the monkeys.

var. **alata**, C.B.Cl.

Caledon River, *Burke*, 301; Leribe, *A. Dieterlen*, 548!

DISTRIBUTION: Bathurst. Uitenhage. Natal. Orange Free State (no locality).

SESUTO : *Qhèmè*. A head ornament consisting of a stick trimmed with the feathers of vultures. *Robo*. Meaning unknown.

**K. erecta**, Schumach.

Damp spots near water-courses. 5–20 in. high, spikelets yellowish. Summer. *A. Dieterlen*, 211!; Banks or streams, *Phillips*. 796!; Caledon River, *Burke*. 425.

DISTRIBUTION : Uitenhage. Albany. Queenstown. King William's Town. Komgha. Transkei. Natal. Delagoa Bay. Transvaal (Bosch Veld, Hooge Veld, Pretoria).

SESUTO : *Sechàbo*. Meaning unknown. Used as a bed on which to lay skins that are being rubbed to make them supple.

**K. pulchella**, Kunth.

Damp spots near water-courses. 6–18 in. high. spikelets brown. Summer. *A. Dieterlen*, 604!; *Phillips*, 858!; 928!

DISTRIBUTION : Albert. Somerset East. Komgha. Orange Free State (Riet River). Transvaal (Trigard's Fontein, Houtbosch).

SESUTO : *Qoqothoane e nyenyane*. The small "qoqothoane." *Rororonyana*. The small "Rororo."

PYCREUS, *Beaur.*

**P. flavescens**, Reichb.

Leribe, *A. Dieterlen*, 770!

DISTRIBUTION : Natal. Orange Free State. Transvaal (Houtbosch).

SESUTO : *Taoane* or *Motaoataoane*. Common names for the *Cyperaceae*.

**P. macranthus**, C.B.Cl.

Natal, Muhlamba Range, 5–6000 ft., *Sutherland*.

DISTRIBUTION : Somerset East. King William's Town. Komgha. Tembuland. Natal. Transvaal (Magaliesberg, Houtbosch).

**P. Mundii**, Nees.

Veld and plateau. Spikelets brown. Summer–Autumn. *A. Dieterlen*. 910!

DISTRIBUTION : Cape. Port Elizabeth. Natal. Delagoa Bay, Transvaal (Matebe River).

SESUTO : *Taoane* or *Motaoataoane*.

**P. ferrugineus**, C.B.Cl

Leribe, *A. Dieterlen*, 597!



DISTRIBUTION: Komgha. Pondoland. Natal.

SESUTO: *Motaoataoane o moholo oa liliba*. The big "Motaoataoane" of the springs.

**P. umbrosus**, Nees.

Mountain slopes and plateau. 8-20 in. high, spikelets light-brown. Autumn. *A. Dieterlen*, 595a! 596! 771!; in streams, *Phillips*, 801!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1865!

DISTRIBUTION: Clanwilliam. Cape. Paarl. Worcester. Caledon. Riversdale. Knysna. Uitenhage. King William's Town. East Griqualand. Natal. Transvaal (Pretoria, Donker's Hoek).

SESUTO: *Motaoataoane oa liliba*. The "Motaoataoane" of the springs. A medicine for chest colds is prepared from the plant. The rhizomes are scented; they are dried, scraped, and threaded as a necklace or put among clothes.

**P. oakfortensis**, C.B.Cl.

Water courses on mountain slopes. Spikelets brown, *A. Dieterlen*, 947!

DISTRIBUTION: Natal. Transvaal (Lomati Valley).

SESUTO: *Taoane*. Meaning unknown.

**P. angulatus**, Nees.

Water courses on mountain slopes. Summer. *A. Dieterlen*, 596 b!

DISTRIBUTION: Queenstown. Komgha. Tembuland. Pondoland. Transvaal (Pretoria).

SESUTO: *Motaoataoane oa lilibo*. The "Motaoataoane" of the fountains.

CYPERUS, *Linn.*

**C. compactus**, Lam. var. *flavissimus*, C.B.Cl.

Veld and plateau. 3-18 in. high. Spikelets yellow. Summer-Autumn. *A. Dieterlen*, 181!; *Phillips*, 864!

DISTRIBUTION: Clanwilliam. Uitenhage. Alexandria. Bathurst. Albany. Fort Beaufort. Cathcart. Komgha. Transkei. Tembuland. Pondoland. East Griqualand. Natal. Orange Free State (no locality). Transvaal (Magaliesberg, Pretoria, Mooi River).

SESUTO: *Leyabutte*. He who grows slowly. *Monokotsoai oa litsoene*. The mulberry of the monkeys. Girls when going to a feast wear wreaths made with the bright yellow inflorescences.

**C. semitrifidus**, Schrad.

Veld, mountain slopes, and plateau. 2-15 in. high. Spikelets brown. Summer. *A. Dieterlen*, 398! 595 b; *Phillips*, 940!

DISTRIBUTION : Uitenhage. Alexandria. Somerset East. Komgha. Transvaal (no locality).

SESUTO : *Hlohōana ntsō*. The small black head.

**C. difformis**, Linn.

Streams on plateau. Spikelets brown. March. *A. Dieterlen*, 775 ! 912 !

DISTRIBUTION : Albany. Somerset East. Komgha. Transkei. Pondoland. Natal. Transvaal (Bosch Veld).

SESUTO : *Rorotoanyane*. *Taoane*. Meaning unknown.

**C. haematocephalus**, C.B.Cl.

Veld and water courses on mountain slopes. 15–25 in. high, spikelets brown. March–April. *A. Dieterlen*, 238 b ! 775 b !

DISTRIBUTION : Natal. Orange Free State (no locality). Transvaal (Hooge Veld).

SESUTO : *Motolo o monyenyane*. The small round thing. Used for plaiting baskets.

**C. marginatus**, Thunb.

Water courses. 8–30 in. high. Spikelets brown. Summer. *A. Dieterlen*, 202 ! ; Basutoland, *Zeyher*, 8 ; Caledon River, *Burke* ; Boster's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1866 !

DISTRIBUTION : Namaqualand Minor. Clanwilliam. Worcester. Port Elizabeth. Cathcart. Queenstown. Calvinia. Beaufort West. Somerset East. Richmond. Colesberg. Albert. Aliwal North. Komgha. Natal. Griqualand West. Orange Free State (Kaffirfontein, Winburg). Transvaal (Hooge Veld, Vaal River).

SESUTO : *Loli*. Meaning unknown. Used largely for making mats, baskets, and beer-strainers.

**C. albostriatus**, Schrad.

Leribe, *A. Dieterlen*, 839 !

DISTRIBUTION : Port Elizabeth. Alexandria. Albany. Bathurst. Somerset East. King William's Town. Komgha. Tembuland. Pondoland. East Griqualand. Natal. Transvaal (Houtbosch).

SESUTO : *Tavane*. *Motavatavane*. Meanings unknown.

**C. latifolius**, Poir.

Between Harrismith and Leribe, *Buchanan*, 215.

DISTRIBUTION : Transkei. East Griqualand. Natal.

**C. aristatus**, Rottb.

Plateau 3–6 in. high. Spikelets brown. Autumn. *A. Dieterlen*, 859 !

DISTRIBUTION: Transvaal (between Porter and Trigard's Fontein).  
 SESUTO: *Qoqothvanenyana*. The small "Qoqothvane."

**C. usitatus**, Burch.

Leribe, *A. Dieterlen*, 188!; slopes behind the Mission Station, *Phillips*, 524!; slopes above Khaniane, growing in patches, *Phillips*, 913!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1873!; Caledon River, *Zeyher*, 1743, *Burke*, 302; near Buffalo River Waterfall, Basutoland, 8200 ft., March, *Galpin*, 6872.

DISTRIBUTION: Namaqualand Minor. Paarl. Uitenhage. Bathurst. Prince Albert. Somerset East. Hope Town. Albert. Aliwal North. Colesberg. Griqualand West. Orange Free State (Bloemfontein). Transvaal (Bamboe's Spruit).

SESUTO: *Monakalali*. Meaning unknown. *Mosela-Khaka*. Derived from the verb "ho sela"—to go about looking for food—and "Khaka"—the crowned guinea-fowl (*Numida coronata*). Children eat the small bulbs either raw or roasted. In times of famine the bulbs are crushed and cooked to make a kind of porridge.

**C. esculentus**, Linn.

Between Harrismith and Leribe, *Buchanan*, 212.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Pretoria, Houtbosch).

**C. longus**, Linn. var. *tenuiflorus*, Boeck.

Leribe, *A. Dieterlen*, 201!

DISTRIBUTION: Clanwilliam. Cape. Paarl. Tulbagh. Worcester. Swellendam. Queenstown. Prince Albert. Richmond. Albert. Hope Town. Griqualand West. Transvaal (Pretoria).

SESUTO: *Motavatawane*. Meaning unknown. See note under *Pycneus umbrosus*.

**C. fastigiatus**, Rottb.

Leribe, *A. Dieterlen*, 692!

DISTRIBUTION: Clanwilliam. Cape. Stellenbosch. Riversdale. Uitenhage. Albany. Queenstown. Aliwal North. King William's Town. Transkei. Natal. Griqualand West. Orange Free State (near Winburg). Transvaal (near Klerksdorp, Hooge Veld).

SESUTO: *Mothoto*. Meaning unknown. The smoke produced when the plant is burnt is supposed to cure pains in one's side. The stems are used for thatching the temporary huts erected in the grain fields, which serve as a shelter to the person occupied in scaring away birds from the ripening grain.

**C. Schlechteri**, C.B. Cl.

Damp spots on mountain slopes. 5-15 in. high, spikelets brown. Summer. *A. Dieterlen*, 757!

SESUTO: *Rororoana*. The small "Rororo."

MARISCUS, *Gaertn.*

**M. capensis**, Schrad.

Damp spots on veld and mountain slopes. 4-20 in. high, spikelets greenish. Summer. *A. Dieterlen*, 603!; slopes behind the Mission Station, *Phillips*, 525!; Caledon River, *Burke*, 303.

DISTRIBUTION: Uitenhage. Somerset East. Bechuanaland. Transvaal. Delagoa Bay.

SESUTO: *Qoqothoane e nyenyane*. The small "Qoqothoane."

**M. congestus**, C.B. Cl.

Leribe, *A. Dieterlen*, 209!; common in damp places, *Phillips*, 621! 671! 789! 909! 988!; Natal, Mohlamba Range, 5-6000 ft., *Sutherland*.

DISTRIBUTION: Cape. Paarl. Worcester. Cathcart. Queens-town. Graaff Reinet. Komgha. Pondoland. Natal. Griqualand West. Orange Free State. Transvaal (Pretoria, Houtbosch).

SESUTO: *Qoqothoane*. This is a common name for many *Cyperaceae*. Used to make baskets and ropes.

ELEOCHARIS, *R. Br.*

**E. palustris**, R. Br.

Damp spots on watercourses on mountain slopes. 4-20 in. high, spikelets brown. Spring. *A. Dieterlen*, 731! (*ex parte*).

DISTRIBUTION: Somerset East. Richmond. Aliwal North. Komgha. Griqualand West.

FIMBRISTYLIS, *Vahl.*

**F. monostachya**, Hassk.

Veld and mountain slopes. 3-15 in. high, spikelets whitish. Summer. *A. Dieterlen*, 549!

DISTRIBUTION: Albany. Queenstown. Komgha. Transkei. Tembuland. Natal. Transvaal (Magaliesberg).

SESUTO: *Leyabuttle*. He who comes slowly.

BULBOSTYLIS, *Kunth.*

**B. humilis**, Kunth.

Mountain slopes and plateau. 1½-8 in. high, spikelets green.

Summer. *A. Dieterlen*, 677!; Wittebergen, 5-6000 ft., *Drège*; Tsitsa footpath, Drakensberg, 7250 ft., March, *Galpin*, 6877.

DISTRIBUTION: Cape. Ceres. Uitenhage. Port Elizabeth. Somerset East. Transkei. Natal. Orange Free State.

SESUTO: *Kaka-hlothoana*. Meaning unknown. (This is also the native name of a bird, viz., *Pycnonotus nigricans*). *Boea ba ntja*. The hair of a dog. *Sekōlana*. The small head-ornament.

### **B. striatella**, C.B. Cl.

Mountain slopes and plateau. 2-15 in. high, spikelets brownish. Summer. *A. Dieterlen*, 471!; rocks at side of stream in ravine, *Phillips*, 732! 738!; rocks near Harrismith, 5000 ft., *Wood* (mixed with No. 4672).

DISTRIBUTION: Natal.

SESUTO: *Hlohoane tsa lehehemu*. The small head of the crane. *Bore ba ntja*. The medicine of the dog.

### **B. schoenoides**, Kunth.

Veld, mountain slopes, and plateau. 5-20 in. high, spikelets cream, brown when mature. Spring-Autumn. *A. Dieterlen*, 605!; Wittebergen, 7-8000 ft., *Drège*, 4378.

DISTRIBUTION: Stockenström. King William's Town.

SESUTO: *Leyabutle le lenyenyane*. The small one which grows slowly.

### **B. scleropus**, C.B. Cl.

Banks of streams on mountain slopes. 6-15 in. high, spikelets brown. Spring-Summer. *A. Dieterlen*, 335!

DISTRIBUTION: Tembuland. Transvaal (Aapie's River).

SESUTO: *Leyabutle*. He who eats slowly.

### **B. Burkei**, C.B. Cl.

Caledon River, *Burke*, 332.

DISTRIBUTION: Endemic.

### **B. capillaris**, Kunth.

Water-courses. 3-6 in. high, spikelets brown. February-March. *A. Dieterlen*, 838!

DISTRIBUTION: Pondoland.

SESUTO: *Joang ba nōkana*. The grass of the brook.

### **B. trichobasis**, C. B. Cl.

Stony places on veld and mountain slopes. 3-11 in. high, spikelets dark brown. Summer. *A. Dieterlen*, 646!



DISTRIBUTION: Tropical Africa.

SESUTO: *Leyabutle le letsöana*. The small black one who eats slowly.

**B. Schlechteri**, C. B. Cl.

Mountain slopes, Leribe, *A. Dieterlen*, 731! (*ex parte*).

DISTRIBUTION: Transvaal (Aapie's River).

SCIRPUS, *Linn.*

**S. fluitans**, *Linn.*

Natal, Van Reenen's Pass, 5800 ft., *Kuntze*, 234.

DISTRIBUTION: Tulbagh. Worcester. Somerset East. King William's Town. Transvaal (Hooge Veld).

**S. Ludwigii**, Boeck. var. *tenuior*, Kunth.

Caledon River, *Burke*.

DISTRIBUTION: Alexandria. Uitenhage.

**S. setaceus**, *Linn.*

Damp spots near water-courses. 2-18 in. high, spikelets greenish-grey. Summer-Autumn. *A. Dieterlen*, 706!

DISTRIBUTION: Uitenhage. Graaff Reinet. Transvaal (Hooge Veld, Houtbosch).

SESUTO: *Boleanyana*. The small smooth thing. *Leshōmōkhō*. Meaning unknown.

**S. macer**, Boeck.

Water-courses. 4-20 in. high, spikelets brownish. Spring. *A. Dieterlen*, 394!; damp banks of stream, *Phillips*, 788!

DISTRIBUTION: Natal. Transvaal (Houtbosch). Orange Free State (no locality).

SESUTO: *Bolibana*. The small hole. ("Boliba" = a deep hole in a river).

**S. cernuus**, Vahl.

Damp spots near water-courses. 2-8 in. high, spikelets greenish. Summer-Autumn. *A. Dieterlen*, 705!

DISTRIBUTION: Namaqualand Minor. Cape. Robertson. Mossel Bay. Port Elizabeth. Albany. Fort Beaufort. Queenstown. Somerset East. King William's Town. Tembuland. Natal. Transvaal.

SESUTO: *Leshōmōkhoana*. Meaning unknown, Ground together with a locust (which has the same Sesuto name) to make a medicine for ailing children.

var. *subtilis*, C. B. Cl.

Wittebergen, 5-6000 ft., *Drège*, 7411.

DISTRIBUTION: Paarl. Swellendam. Uitenhage. Komgha. Natal.

*S. Burkei*, C. B. Cl.

Leribe, *A. Dieterlen*, 238a!; *Buchanan*, 150; Caledon River, *Burke*, 231; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1875!

DISTRIBUTION: Transvaal (Magaliesburg, Middleburg, Johannesburg).

SESUTO: *Motolo*. Derived from the verb "ho tolokana," to be round (referring to the round spikelets). *Molika-seolo*. He who surrounds the ant heap. The split stems are used to plait hats and mats.

*S. varius*, C. B. Cl.

Basutoland, without precise locality, *Buchanan*, 225.

DISTRIBUTION: Transvaal (Aapie's River, Houtbosch).

*S. falsus*, C. B. Cl.

Veld and plateau. 10-20 in. high, spikelets blackish. Summer. *A. Dieterlen*, 594a! 594b!; Bester's Vlei, near Witzie's Hoek, 5500 ft., December, *Flanagan*, 1874!; Mont-aux-Sources, 9500 ft., *Flanagan*, 2010! 2011!; Natal, Bushman's River Valley, 6-8000 ft., October, *Wood*, 10882!; summit of Doodman's Krans and Ben McDhui, 9650-9850 ft., March, *Galpin*, 6873, 6874.

DISTRIBUTION: Endemic.

SESUTO: *Sechaba sa matlapa*. The "Sechaba" of the stony places (or flat stones).

*S. paludicola*, Kunth.

Water-courses on mountain slopes. 7-36 in. high, spikelets brown. Spring. *A. Dieterlen*, 733! 769!

DISTRIBUTION: Swellendam. Alexandria. Bathurst. Cathcart. Queenstown. Beaufort West. Somerset East. King William's Town. Komgha. East Griqualand. Natal. Orange Free State.

SESUTO: *Rororoana*. The small "Rororo" ("Rororo" is the common name for the *Juncaceae*). A medicine for colic is prepared from it.

*S. Hystrix*, Thunb.

Water-courses. 1-3 in. high, spikelets greyish. Summer. *A. Dieterlen*, 835!

DISTRIBUTION: Namaqualand Minor. Cape. Paarl. Worcester. Natal.

SESUTO: *Qoqothoanyane*. The small "Qoqothoane."

**S. sp.** (cf. *S. cernuus*, Vahl).

Ben McDhui, 9300 ft., March, *Galpin*, 6878.

FICINIA, *Linn.*

**F. filiformis**, Schrad.

Mountain slopes near rocks. 6-15 in. high, spikelets brown. Summer-Autumn. *A. Dieterlen*, 721!

DISTRIBUTION: Cape. Tulbagh. Worcester. Caledon.

SESUTO: *Letjotjo*. Meaning unknown. *Sechabana*. The small "Sechaba."

**F. stolonifera**, Boeck.

Natal, Van Reenen, 5600 ft., *Kuntze*, 235.

DISTRIBUTION: Cape. Riversdale. Somerset East.

**F. cinnamomea**, C. B. Cl.

Wittebergen, *Cooper*, 635.

DISTRIBUTION: Komgha. Natal.

**F. gracilis**, Schrad.

Mountain slopes and plateau, near rocks. 10-22 in. high, spikelets brown. Summer. *A. Dieterlen*, 667!

DISTRIBUTION: Riversdale. Mossel Bay. Humansdorp. Uitenhage. Albany. Somerset East. Pondoland.

SESUTO: *Sechaba sa mafika*. The "Sechaba" of the rocks.

FIURENA, *Rottb.*

**F. coerulescens**, Steud.

Damp spots near water-courses. 6-22 in. high, spikelets greenish. Spring. *A. Dieterlen*, 504!

DISTRIBUTION: Cape. Natal.

SESUTO: *Sechaba sa liliba*. The "Sechaba" of the fountains.

LIPOCARPA, *R. Br.*

**L. pulcherrima**, Ridley.

Leribe, *A. Dieterlen*, 901!

DISTRIBUTION: Natal. Transvaal (Pretoria).

SESUTO: *Qoqothoane e nyenyane*. The small "Qoqothoane."

ASCOLEPIS, *Steud.***A. capensis**, Ridley.

Nelson's Kop, *Cooper*, 911; Bester's Vlei, near Witzie's Hoek, 6400 ft., December, *Flanagan*, 1844!

DISTRIBUTION: Stockenstroom. Tembuland. Pondoland. Natal. Transvaal (Pretoria, Magaliesberg, Komati River).

RYNCHOSPORA, *Vahl.***R. glauca**, Vahl.

Leribe, *A. Dieterlen*, 766a!

DISTRIBUTION: Cape. Natal. Transvaal (Houtbosch, Barberton).

SESUTO: *Mohloelo-mayoe*. He who spies the stones.

SCLERIA, *Berg.***S. dregeana**, Kunth.

Plateau, 8–15 in. high, spikelets dark brown. Summer. *A. Dieterlen*, 889!; Basutoland, without precise locality, *Cooper*, 3365.

DISTRIBUTION: Stockenstroom. Komgha. Tembuland. Pondoland.

SESUTO: *Motsötsöë*. Dampness (due to water oozing from the ground after rain).

**S. Woodii**, C.B. Cl.

Shady spots on mountain slopes. 10–30 in. high, spikelets brown. Summer. *A. Dieterlen*, 766b!; Drakensberg Range, near Harrismith, *Buchanan*, 114.

DISTRIBUTION: Komgha. Natal. Zululand. Transvaal (Oliphant's River).

SESUTO: *Mohloelo-mayö o monyenyane*. The small one who spies the stones.

**S. Dieterlenii**, Turrill.

Plateau. 5–13 in. high, spikelets brown. Summer. *A. Dieterlen*, 749!

DISTRIBUTION: Endemic.

SESUTO: *Molika-letosāna*. He who surrounds the pond.

SCHOENOXIPHIMUM, *Nees.***S. rufrum**, Nees.

Damp spots on mountain slopes. Summer. *A. Dieterlen*, 759a!

DISTRIBUTION: Port Elizabeth. Queenstown. Somerset East.

King William's Town. Pondoland. Natal. Orange Free State (without locality).

**S. sparteum**, Kük. forma **rigidum**, Kük.

Summit Doodman's Krans Mountain, 9650 ft., March, *Galpin*, 6879.

The above identification was given by Kew to Mr. Galpin. Dr. Bolus determined the plant as *Carex Bolusii*, C.B. Cl.

var. **Lehmanii**, Kük.

In Pot River Berg Forest, 5500 ft., March, *Galpin*, 6880.

This identification was given by Kew. The plant was formerly determined as *Carex esenbeckiana*, Boeck.

**S. Basatorum**, Turrill.

Plateau. Spikelets brownish. December. *A. Dieterlen*, 948!

DISTRIBUTION: Endemic.

SESUTO: *Boleane ba sehlabo*. The softness of the plateau.

## CAREX, Linn.

**C. glomerata**, Thunb.

Mountain slopes and plateau, under rocks. 6–25 in. high, spikelets greenish. Summer. *A. Dieterlen*, 758! 890!

DISTRIBUTION: Riversdale. Albany. Uitenhage. Orange Free State (no locality).

SESUTO: *Boleane ba liliba bo bonyenyane*. The small smooth object of the fountain. *Sechabana*. The small "Sechaba."

**C. Phacota**, Spreng.

Damp spots on mountain slopes. 10–15 in. high, spikelets brown. Spring. *A. Dieterlen*, 860!; Nelson's Kop, *Cooper*, 909, 3335.

DISTRIBUTION: Natal. Transvaal (Pretoria).

SESUTO: *Lesuoane le lenyenyane*. The small "Lesuoane." Used by the natives as a mat on which to soften skins.

**C. dregeana**, Kunth.

Damp spots on the banks of streams. 10–30 in. high, spikelets brownish. Summer. *A. Dieterlen*, 393! 759b!

DISTRIBUTION: Tulbagh. Swellendam. Alexandria. Albany. Somerset East. Tembuland. Natal.

SESUTO: *Boleane ba liliba*. The smooth thing of the fountains.



*Lesuoane le lenyenyane*. The small "Lesuoane." Used as a mat on which to soften skins. Also used to plait boys' hats.

**C. esenbeckiana**, Boeck.

Natal, Van Reenen's Pass, 5800 ft., *Kuntze*, 290.

DISTRIBUTION: Alexandria. Albany. King William's Town.

**C. spicato-paniculata**, C.B. Cl.

Orange Free State, on the Drakensberg Range, *Cooper*, 1066.

DISTRIBUTION: Natal. Transvaal (Houtbosch).

**C. Buchanani**, C.B. Cl.

Leribe, *A. Dieterlen*, 759a!

DISTRIBUTION: Natal.

SESUTO: *Boleana ba liliba bo boholo*. The big smooth thing of the fountains.

**C. flava**, Linn.

Mont-aux-Sources, 9500 ft., *Flanagan*, 2013.

DISTRIBUTION: Endemic to this region, but also found in Europe and North America.

**C. clavata**, Thunb.

Damp spots on mountain slopes. 20-45 in. high, spikelets brown. *A. Dieterlen*, 601.

DISTRIBUTION: Malmesbury. Cape. Paarl. Port Elizabeth. Bathurst. Orange Free State (no locality).

SESUTO: *Lesuane*. Derived from the verb "ho sua"—to make a skin supple. The natives use it as a mat on which to soften skins; also used to make hats. In former times the shepherds used to make from the stems a roughly plaited coat to wear in the rainy season.

**C. drakensbergensis**, C.B. Cl.

Drakensbergen, near Harrismith, *Buchanan*, 112, 136; Ben McDhui, 9000 ft., March, *Galpin*, 6881.

DISTRIBUTION: East Griqualand. Natal. Transvaal (Potchefstroom).

**C. sp.** (near *C. clavata*, Thunb.).

Doodman's Krans Mountain, 8650 ft., March, *Galpin*, 6882.

Dr. Bolus determined this as *C. clavata*, Thunb. The above identification is from Kew.

GRAMINEAE.

IMPERATA, *Cyr.*

**I. arundinacea**, *Cyr.*, var. **Thunbergii**, *Hack.*

Damp spots on mountain slopes and dongas. 18–30 in. high, spikes whitish. Summer. Common. *A. Dieterlen*, 212!; between Harri-smith and Leribe, *Buchanan*, 206!

DISTRIBUTION: Clanwilliam. Cape. Humansdorp. Albany. Tembu-land. Natal. Griqualand West. Transvaal (Pretoria, Matebe Valley). Bechuanaland (near Kuruman).

SESUTO: *Mohlorumo* or *Mohlaba-lerumo*. Derived from the verb “ho hlaba”—to pierce and “lerumo”—an assegai, in reference to the leaf being shaped like an assegai. The inflorescence is called “Qheme,” which is the name of a head ornament made of a stick decorated with feathers of vultures. The raw roots are eaten by young herds, and from the roots also a medicine is prepared and given to children suffering with a cold on the chest.

SACCHARUM, *Linn.*

**S. munroanum**, *Hack.*

Drakensbergen, near Coldstream, 5–6000 ft., *Rehmann*, 6876.

DISTRIBUTION: Transvaal (Magaliesberg). Rhodesia (Matopo Hills).

ERIANTHUS, *Michx.*

**E. Sorghum**, *Nees.*

Banks of rivers and dongas. 4–6 ft. high, spikes cream-brownish. *A. Dieterlen*, 224!; Lefi's Kloof, N.E. slopes of Leribe plateau, occa-sional, *Phillips*, 850!; near Buffalo River Waterfall, 8000 ft. March, *Galpin*, 6890!

DISTRIBUTION: Tulbagh. Queenstown. Graaff Reinet. Tembu-land. Orange Free State (Sanddrift Spruit).

SESUTO: *Mothala*. Meaning unknown. Used for thatching huts. The leaves cause a rash when rubbed on the skin; the raw roots are chewed by the native children. Used medicinally.

ISCHAEMUM, *Linn.*

**I. Franksae**, *J.M.W.*

Natal, Tabanhllope, 6–8000 ft., October, *Wood*, 10540!

DISTRIBUTION: Endemic.

ROTTBOELLIA, *Linn. f.***R. compressa**, *Linn. f.*, var. *fasciculata*, *Hack.*

Water courses. 20–38 in. high, spikes yellowish-red. Autumn. *A. Dieterlen*, 574!; stream on Leribe plateau, *Phillips*, 804!

DISTRIBUTION: Clanwilliam. Cape. Paarl. Tulbagh. Worcester. Stellenbosch. Caledon. Swellendam. Uitenhage. Albany. Graaff Reinet. Tembuland. Natal.

SESUTO: *Tayoe*. Meaning unknown. *Namele*. He who spreads. *Marotlo a mafulelu*. The red “marotlo” (meaning of “marotlo” unknown). Grazed and liked by cattle. Children eat the raw roots. This is one of the grasses used for building the “seotloana,” an enclosure near the huts.

URELYTRUM, *Hack.***U. squarrosum**, *Hack.*

Between Harrismith and Leribe, *Buchanan*, 213!

DISTRIBUTION: Natal. Transvaal (Pretoria, near Maquasi Mountains, Mooi River).

TRACHYPOGON, *Nees.***T. polymorphus**, *Hack.*, var. *capensis*, *Hack.*

A rare grass, *A. Dieterlen*, 210b!

DISTRIBUTION: Riversdale. Uitenhage. Port Elizabeth. Alexandria. Bathurst. Albany. Transkei. Tembuland. Natal. Orange Free State. Transvaal (Johannesburg, Houtbosch).

SESUTO: *Selökana*. Meaning unknown.

ELIONURUS, *H. and B.***E. argenteus**, *Nees.*

Veld and plateau. 10–22 in. high, spike whitish. Summer. Common. *A. Dieterlen*, 177!; mountain slopes behind the Mission Station, *Phillips*, 504!; Leribe plateau, *Phillips*, 693!; south slopes of Leribe plateau, above Khaniane, *Phillips*, 933!; Drakensbergen, Giant's Castle, 8–9000 ft.. October, *Wood*, 10543!; Caledon River, *Burke*, 200; moist rocky places on the Wittebergen, 5–6000 ft., *Drège*.

DISTRIBUTION: Uitenhage. Alexandria. Albany. Fort Beaufort. Stockenström. Albert. Aliwal North. Komgha. Tembuland. Natal. Zululand. Orange Free State (Draaifontein). Transvaal (Vaal River, Houtbosch).

SESUTO: *Hlökō*. Meaning unknown. A good spring and summer grazing grass. Used medicinally for colic.

ANDROPOGON, *Linn.*

**A. ceresiaeformis**, Nees.

Mountain slopes and plateau. 10–18 in. high, spikes reddish. Autumn. *A. Dieterlen*, 464!; summit of Pot River Berg, 6470 ft., March, *Galpin*, 6898.

DISTRIBUTION: Pondoland. East Griqualand. Natal. Orange Free State. Transvaal (Johannesburg, Aapie's River, Houtbosch).

SESUTO: *Mobeseletso* or *'Meseletsö*. Something which is burned for a purpose. Derived from the verb “ho beseletsa”—to burn for. During autumn the natives burn this grass in their cultivated lands, with the belief that the smoke will help the grain to ripen quickly. Not much eaten by cattle.

**A. eucomus**, Nees.

Hill slopes. 10–16 in. high, spikes whitish. Tejatejaneng. April *A. Dieterlen*, 816!

DISTRIBUTION: Clanwilliam. Cape. Tulbagh. Port Elizabeth. Albany. Natal. Hay. Bechuanaland (near Kuruman). Transvaal (Nile river, Houtbosch). Rhodesia (Matopo Hills).

SESUTO: *Mohlaala*. Meaning unknown.

**A. appendiculatus**, Nees.

Veld and plateau.  $1\frac{1}{2}$ – $4\frac{1}{2}$  ft. high, spikes reddish. Summer. Not uncommon. *A. Dieterlen*, 349!; without precise locality, *Cooper*; Caledon River, *Burke*, *Zeyher*, 1801!; Ben McDhui, 9900 ft., March. *Galpin*, 6896!

DISTRIBUTION: Clanwilliam. Tulbagh. Worcester. Uitenhage. Port Elizabeth. Albany. Fort Beaufort. Queenstown. Albert. Komgha. Tembuland. Natal. Transvaal (Steel Poort, Johannesburg, Pretoria, Magaliesberg, Matjesgoed Spruit).

SESUTO: *Mochela*. Meaning unknown. Not much liked by cattle.

**A. schirensis**, Hochst., var *angustifolia*, Stapf.

Stony spots on veld and hill slopes. 10–35 in. high, spikes whitish-red. Autumn. *A. Dieterlen*, 397b!; Leribe, *Buchanan*, 144; near Harris Smith, *Buchanan*, 120; Thaba Unchu, *Burke*, 434!

DISTRIBUTION: Natal. Transvaal (Pretoria, Aapie's River).

SESUTO: *Hlōkō ea matlapa*. The “Hlōkō” of the flat stones. Meaning unknown.

**A. amplexens**, Nees.

Basutoland, without locality, *Marloth*, 1114.

DISTRIBUTION: Tembuland. Natal. Transvaal (Houtbosch, Makapans Mountains, Dronkfontein, Aapie's River).

**A. filifolius**, Steud.

Veld and hill-slopes. 10-18 in. high, spikes reddish-yellow. Autumn. *A. Dieterlen*, 397a!; Giant's Castle, 8-9000 ft., October, *Wood*, 10546!

DISTRIBUTION: Port Elizabeth. Alexandria. Bathurst. Natal. Transvaal (Houtbosch).

SESUTO: See *A. Schirensis*, Hochst. var. *angustifolia*, Stapf.

**A. distachys**, Linn.

Witteberg, near Harrismith, *Buchanan*, 263!

DISTRIBUTION: Natal.

**A. Sorghum**, Brot. var. **saccharatus**, Körn.

Cultivated. 5-7 ft. high. Summer-Autumn. *A. Dieterlen*, 698!

DISTRIBUTION: Cultivated in tropical and sub-tropical regions.

SESUTO: *Ntsöe*. Meaning unknown. Said to be indigenous. The sweet stem is chewed in autumn. A preparation of this plant and *Erigeron canadense*, Linn., is used for eczema; it is applied to the eruption, which is then rubbed with fat. This operation must be performed by the first cousin of the sick person, otherwise the natives believe it will have no effect.

**A. contortus**, Linn.

Leribe, *A. Dieterlen*, 210a!; mountain slopes south of the Mission Station, *Phillips*, 647! 695!; summit Pot River Berg, 6200 ft., March *Galpin*, 6895!; Caledon River, *Burke*.

DISTRIBUTION: Swellendam. Riversdale. George. Knysna. Uitenhage. Port Elizabeth. Alexandria. Fort Beaufort. Stocken-stroom. Tembuland. Natal. Prince Albert. Aberdeen. Somerset East. Graaff Reinet. Albert. Hay. Orange Free State (near Winburg). Transvaal (Pretoria).

SESUTO: *Selökana*. Meaning unknown. A spring grazing grass. Used, together with *Tribulus terrestris*, Linn., as a medicine for rheumatism in the hands. (The natives believe that you must use a stinging plant to cure a disease with acute pain.)

**A. Nardus**, Linn., var. **marginatus**, Hack.

Mountain slopes, spikes yellowish. Autumn. *A. Dieterlen*, 390!; Buffalo River, Waterfall, 7750 ft., March, *Galpin*, 6897!

DISTRIBUTION: Cape. Worcester. Caledon. Riversdale. Aliwal North.

SESUTO: *Lebate* or *Lebata*. Derived from the verb "hobata"—to be cold. Grazed by cattle and goats. Used as a medicine for chest complaints.



**A. plurinodis**, Stapf (*Cymbopogon plurinodis*, Stapf).

Between Harrismith and Leribe, *Buchanan*, 207!

DISTRIBUTION: Fort Beaufort. Queenstown. Graaff Reinet. Albert. Natal. Herbert. Hay. Transvaal (Lydenberg). Bechuanaland.

**A. Schoenanthus**, Linn., var. **versicolor**, Hack (*Cymbopogon excavatus*, Stapf).

Veld and mountain slopes. 15–38 in. high, spikes yellowish-green. Autumn. *A. Dieterlen*, 213!; ravine on west slopes of Leribe plateau, *Phillips*, 590!; Caledon River, *Burke*, 199!

DISTRIBUTION: East Griqualand. Natal. Hay. Orange Free State (near Winburg, Bloemfontein). Transvaal (Johannesburg, Aapie's River, Houtbosch). Bechuanaland (near Kosi Fontein).

SESUTO: *Patieane*. Meaning unknown. Cattle are not partial to this grass on account of its bitterness. Woven into rough mats in which rolls of tobacco are wrapped. Placed under and at the bottom of the large grain baskets ("lisin") to keep away rats and mice, which will not gnaw through it on account of its bitter properties. Mixed with other plants to make "medicine."

**A. hirtus**, Linn. (*Cymbopogon hirtus*, Stapf).

Veld and hill slopes. 3–9 ft. high, spikes reddish-yellow. Autumn. *A. Dieterlen*, 203! 205!; mountain slopes above the Mission Station, *Phillips*, 500!, Lef's Kloof, N.E. slopes of Leribe plateau, common, *Phillips*, 831!, principal component of grassland of mountain slopes, *Phillips*, 849!.

DISTRIBUTION: Cape. Worcester. Stellenbosch. Riversdale. Uitenhage. Albany. King William's Town. Graaff Reinet. Cradock. Aliwal North. Hay. Orange Free State (Bloemfontein). Transvaal (near Klippan). Bechuanaland (near Takum).

SESUTO: *Dieterlen*, 203. *Môokoana oa tséphè*. Small chaff of the springbok. *Moful' a tséphè*. Grazing of the springbok. Grazed by cattle and horses. (Madame Dieterlen notes that No. 203 is probably a young state of No. 205, but some of the natives deny this.) *Dieterlen*, 205. *Mohlômō*. Derived from the verb "ho hloma," to grow again. Largely used for thatching huts and for making the large grain baskets ("lisin").

**A. auctus**, Stapf (*Cymbopogon auctus*, Stapf).

Veld, dongas, and hill slopes. 5–8 ft. high, spikes greenish-brown. Autumn. *A. Dieterlen*, 206!; mountain slopes above the Mission Station, *Phillips*, 500a!; Thaba Uchu, *Burke*, 427!, *Zeyher*, 1799.

DISTRIBUTION: Uitenhage. Queenstown. East Griqualand. Natal.

SESUTO: *Qokoa*. Meaning unknown. Grazed by cattle and horses. It is said to be the best and most lasting thatching grass.

**A. Dieterlenii**, Stapf, sp. nov. (*Cymbopogon Dieterlenii*, Stapf).

Mountain slopes. 28–36 in. high, spikes yellowish. Summer–Autumn. *A. Dieterlen*, 390b!

DISTRIBUTION: Endemic.

SESUTO: *Lebatjana*. The small “Lebate.” This grass, together with *Elionurus argenteus*, Nees, is burnt and mixed with water, and used to sprinkle a person suffering with “Molikana,” a disease which causes eruptions on the body through not having undergone certain tribal rites. Also used as a medicine for wounds and as “Molitola” medicine to make young people true and strong men.

#### ANTHISTIRIA, *Linn. fil.*

**A. imberbis**, Retz.

Wittebergen, 7–8000 ft., *Drège*.

DISTRIBUTION: Clanwilliam. Cape. Worcester. Riversdale. George. Port Elizabeth. Alexandria. Albany. Beaufort West. Queenstown. Albert. Aberdeen. Graaff Reinet. Tembuland. Natal. var. *mollicoma*, Stapf.

Veld and mountain slopes. 20–30 in. high, spikes reddish-yellow. Summer–Autumn. Very common. *A. Dieterlen*, 381!; slopes behind the Mission Station, stream on plateau and Qoqolosi Peak, *Phillips*, 502! 778! 957!; Caledon River, *Burke*, 423!

DISTRIBUTION: Riversdale. George. Albany. Natal. Griqualand West. Transvaal (Wonderfontein).

SESUTO: *Sebōku*. Meaning unknown. A good summer grazing grass. Used for thatching when no other grass is available.

#### DIGITARIA, *Rich.*

**D. monodactyla**, Stapf.

Plateau. 7–16 in. high, spikes yellowish. Summer. Not very common. *A. Dieterlen*, 743!; mountain slopes south of the Mission Station and on plateau, *Phillips*, 694!; Drakensberg, near Harrismith, *Buchanan*, 121!; Wittebergen, 5000 ft., *Drège*.

DISTRIBUTION: Alexandria. Orange Free State (Winburg). Transvaal (Aapie's River).

SESUTO: *Bohobe ba linonyana*. The bread of the birds. *Mo-oratlapana*. He who faces the small flat stone. A grazing grass.

**D. eriantha**, Steud.

Mountain slopes and plateau. 12–28 in. high, spikes greenish. Summer. *A. Dieterlen*, 768!; stream on plateau, common, *Phillips*, 800!; between Aliwal North and Kraai River, *Drège*.

DISTRIBUTION: Uitenhage. Alexandria. Bathurst. Albany. King William's Town. Queenstown. Prince Albert. Somerset East. Graaff Reinet. Tembuland. Natal. Hay. Prieska. Orange Free State. Transvaal (Pienaar's River).

SESUTO: '*Moeane*. That which comes back at the end of the season. Derived from "ho boea"—to come back or return. A grazing grass.

**D. setifolia**, Stapf.

Plateau. 10–20 in. high, spikes yellowish. Summer. Rare. *A. Dieterlen*, 744!

DISTRIBUTION: Albany. Tembuland.

SESUTO: *Lemoko*. Meaning unknown. *Lesale*. Derived from the verb "ho sa"—to be dispersed. A grazing grass.

**D. ternata**, Stapf.

Leribe, *A. Dieterlen*, 472a!

DISTRIBUTION: Queenstown. Transkei. Natal.

SESUTO: '*Moeane*. See *D. eriantha*, Steud. A good grazing grass. Becomes a weed in gardens.

**D. sanguinalis**, Scop.

Leribe, *A. Dieterlen*, 472!

DISTRIBUTION: Clanwilliam. Cape. Swellenden. George. Knysna. Uitenhage. Graaff Reinet. Natal. Hay.

SESUTO: '*Moeane*. See *D. eriantha*, Steud. A good grazing grass. Becomes a weed in gardens.

**D. tricholaenoides**, Stapf.

Veld and mountain slopes. 8–25 in. high, spikes pink. Summer. Not common. *A. Dieterlen*, 816! 817!; Lefi's Kloof, N.E. slopes of Leribe plateau, occasional, *Phillips*, 837!

DISTRIBUTION: King William's Town. Tembuland. Natal.

SESUTO: *Mo hlaba-khama*. He who pricks the hartebeest. *Mo-hloea*. He of the whey. The hollow stems are used to suck up the whey of sour milk. A grazing grass, not common.

PANICUM, *Linn.***P. serratum**, Steud.

Mountain slopes and plateau. 8–20 in. high, spikes pinkish. Spring–Autumn. *A. Dieterlen*, 391!; Qoqolosi Peak, *Phillips*, 970!; without precise locality, *Cooper*, 921.

DISTRIBUTION: Swellendam. Riversdale. Mossel Bay. Humansdorp. Uitenhage. Bathurst. Alexandria. Albany. Fort Beaufort. Stockenström. Cathcart. Queenstown. Somerset East. Albert. Tembuland. Natal. Orange Free State. Transvaal (Wonderfontein, near Lydenburg). Bechuanaland (Kuruman).

SESUTO: *Lengobe la namane*. The knee-joint of a calf. *Lehōlane*. Small weed. A grazing grass.

**P. Isachne**, Roth.

Veld and mountain slopes. 15–25 in. high, spikes greenish. Summer. Frequent. *A. Dieterlen*, 657!; Leribe, *Buchanan*, 145, 230!

DISTRIBUTION: Transkei. Natal. Bechuanaland (Batlapin Country).

SESUTO: *Khōlane*. Small weed. Derived from “lehola”—a weed. A good grazing grass.

**P. Helopus**, Trin. var. **glabrescens**, K. Schum.

Veld and mountain slopes. 10–20 in. high, spikes greenish. Summer. *A. Dieterlen*, 658!; between Harrismith and Leribe, *Buchanan*, 211!

DISTRIBUTION: Queenstown. Natal.

SESUTO: *Lehōla*. Weed. *Mofulú-Khomo*. Grazing of the cattle. A deeply-rooted grass grazed and liked by cattle in autumn.

**P. stagninum**, Koenig.

Near the fountain on Hlotse slope. 3–5 ft. high. May. *A. Dieterlen*, 848!

DISTRIBUTION: Alexandria. Komgha. Transkei.

SESUTO: *Bohōme ba liliba*. The “Bohome” of the fountains. Derived from the verb “ho homa”—to stick to one’s clothes. Use unknown.

**P. aequinerve**, Nees.

Banks of the Little Pot River, 4550 ft., March, *Galpin*, 6886!

DISTRIBUTION: Natal. Pondoland. Transvaal (Houtbosch).

**P. laevifolium**, Hack.

Leribe, *A. Dieterlen*, 543!

DISTRIBUTION: Transvaal (Donker's Hoek, near Wigaardsfontein, Pretoria, near Klippan).

SESUTO: 'Mofa ntso'e o mohola. The big binder of the sugar-cane. This is an autumn grass and is found abundantly in cultivated lands; it is used to make binders for the bundles of sugar-cane (*Ntsoe*). Makes a very good hay.

**P. natalense**, Hochst.

Without precise locality, *Cooper*, 920; Van Reenen, 5-6000 ft., December, *Wood*, 7219!

DISTRIBUTION: Tembuland. Transvaal (Houtbosch, Stinkfontein, Keeron River, near Crocodile River).

AXONOPUS, *Hook. f.*

**A. semialatus**, Hook. f. var. **Ecklonii**, Stapf.

Drakensberg Range, at Polela, 6-7000 ft., *Evans*, 521.

DISTRIBUTION: Alexandria. Albany. Barkly West. Stockenstroom. Komgha. Tembuland. Natal.

SETARIA, *Beauv.*

**S. nigrirostris**, Durand and Schinz.

Veld and roadsides. 10-25 in. high, spikes violet-whitish. Summer-Autumn. *A. Dieterlen*, 292!; Lef's Kloof on N.E. slopes of Leribe plateau, occasional, *Phillips*, 838!; Drakensbergen, near Harrismith, *Buchanan*, 113.

DISTRIBUTION: Queenstown. Komgha. Natal. Transvaal (Klerksdorp, Pietersberg).

SESUTO: *Marotla. Sekhoho*. Grass (meaning of both words). A grazing grass.

**S. Gerrardii**, Stapf.

Leribe, *Buchanan*, 224.

DISTRIBUTION: Natal.

**S. flabellata**, Stapf.

On veld, by roadsides and mountain slopes. 14-22 in. high, spikes yellowish. Summer. Not common. *A. Dieterlen*, 401!; mountain slopes behind the Mission Station, *Phillips*, 505!; ravine on west slopes of Leribe plateau, *Phillips*, 640!; by the Caledon River, *Burke*.

DISTRIBUTION: Swellendam. Riversdale. Knysna. Uitenhage. Port Elizabeth. Alexandria. Bathurst. Tembuland.



**SESUTO:** *Thusane*. Derived from the verb “ho thusana”—to help one another. A grazing grass.

**S. imberbis**, Roem. and Schult.

Veld. 10–20 in. high, spikes violet-whitish. Summer. *A. Dieterlen*, 182!; Van Reenen, 5–6000 ft., March, *Wood*, 5991; near the Tugela River, 6000 ft., *Buchanan*, 176; banks of the Little Pot River, 4550 ft., March, *Galpin*, 6888!

**DISTRIBUTION:** Uitenhage. Queenstown. Komgha. Griqualand West. Transvaal (near Lydenburg). Rhodesia (Matopos).

**SESUTO:** *'Mofa ntso'e*. The binder of the sugar-cane. When the sugar-cane is cut in autumn this grass is used to make binders to tie together the bundles of cane. Makes very good hay.

**S. verticillata**, Beauv.

Mountain slopes in caves and rocks. 15–40 in. high, spikes greenish. Summer. *A. Dieterlen*, 297!

**DISTRIBUTION:** Uitenhage. Albany. Graaff Reinet. Transkei. Tembuland. Natal. Transvaal (Pretoria, Lydenburg, Zoutpans Berg).

**SESUTO:** *Bohōme ba lipoli*. The “Bohome” of the goats. “Bohome” derived from the verb “ho homa”—to stick to. Goats are fond of this grass, and the spikelets are commonly to be found adhering to their bodies; hence the above Sesuto name. Shepherds use this grass to weave hats with.

#### PENNISETUM, Pers.

**P. typhoideum**, Rich.

Cultivated. 4–6 ft. high, spikes brownish. Summer. *A. Dieterlen*, 690!

**DISTRIBUTION:** Cultivated by the natives in South Africa.

**SESUTO:** *Nyalothie*. Meaning unknown. A very intoxicating beer is made from the grains. A medicine is prepared from it and given to cows which are not completely delivered at the birth of their calves. Said to have been introduced into Basutoland from Zululand.

**P. spbacetalum**, Durand and Schinz.

Damp spots on mountain slopes and veld, spikes whitish, 15–38 in. high. Spring–Summer, *A. Dieterlen*, 560!; Leribe, mountain slopes south of the Mission Station, very common, *Phillips*, 651!; Drakensbergen, Satsanna Berg, 9300 ft., March, *Galpin*, 6889!; Van Reenen, 5–6000 ft., March, *Wood*, 5980.

DISTRIBUTION : Queenstown. Somerset East. Aliwal North. Komgha. Transkei. Orange Free State (Winberg). Transvaal (Pretoria).

**P. Thunbergii**, Kunth., var. **Galpinii**, Stapf.

Damp spots. 15–38 in. high, spikelets reddish. Spring–Summer. *A. Dieterlen*, 606 !

DISTRIBUTION : S.W. Africa. Cape. Caledon. Uitenhage. Cathcart. Graaff Reinet. Worcester. Transvaal (near Lydenburg).

SESUTO : *Lehöfe*. Meaning unknown. *Thitapoho*. Strong as a bull.

ANTHEPHORA, *Schreb.*

**A. pubescens**, Nees.

Leribe, *Buchanan*, 134.

DISTRIBUTION : S.W. Africa. Griqualand West. Transvaal (Lydenburg).

TRICHOLAENA, *Schrad.*

**T. setifolia**, Stapf.

Veld and mountain slopes. 10–25 in. high, spikes white or pink. Summer. *A. Dieterlen*, 215a !; 215b !; mountain slopes behind the Mission Station, very common, *Phillips*, 503 !; slopes of ravine between the Mission Station and Jonathan's Village, glumes pink, occasional, *Phillips*, 569 !

DISTRIBUTION : Caledon. Uniondale. Uitenhage. Alexandria. Albany. Queenstown. Somerset East. Graaff Reinet. Komgha. Tembuland. Natal. Griqualand West. Transvaal (Johannesburg, Pretoria, Houtbosch).

SESUTO : *Mohlaha-pele*. He who appears first. *Lechocho*. Meaning unknown. *Ntlo ea thaha*. The house of the *Pyromelana oryx*. The glumes are used by this bird for building its nest. Grazed by cattle.

ARUNDINELLA, *Raddi.*

**A. Ecklonii**, Nees.

Along water-courses. 3–4 ft. high, spikes greyish-red. Summer–Autumn. *A. Dieterlen*, 207 !; ravine on west slopes of plateau, *Phillips*, 604 !, 705 !; Nelson's Kop, 5–6000 ft., March, *Wood*, 6003 !

DISTRIBUTION : George. Uitenhage. Cathcart. Queenstown. Komgha. Natal. Transvaal (Johannesburg).

SESUTO : *Mahlakwane*. Meaning unknown. In summer this grass becomes bitter and is not much liked by cattle. Used in compounding many medicines and also to prepare a lotion for washing wounds.

TRISTACHYA, *Nees*.**T. biseriata**, Stapf.

Basutoland, Leribe, *Buchanan*, 220.

DISTRIBUTION: Endemic.

**T. leucothrix**, Trin.

Veld, mountain slopes, and plateau. 13–22 in. high, spikes reddish-brown. Summer. *A. Dieterlen*, 208!

DISTRIBUTION: Swellendam. George. Uniondale. Humansdorp. Port Elizabeth. Alexandria. Albany. Somerset East. Stockenstroom. King William's Town. Komgha. Tembuland. Pondoland. Natal. Transvaal (near Lydenburg).

SESUTO: *Motsvalle*. The friend.

ACHNERIA, *Munro*.**A. setifolia**, Stapf.

Mountain slopes. 6–22 in. high, spikes greyish-white. Summer. *A. Dieterlen*, 585!; summit Doodman's Krans Mountain, 9650 ft., March, *Galpin*, 6912!; Wittebergen on rocks, 7–8000 ft., *Drège*.

DISTRIBUTION: Uitenhage. Graaff Reinet. Stockenstroom. King William's Town.

SESUTO: *Letsuiri le lenyenyane*. The small "Letsuiri." Meaning unknown. Used by the natives for making hats and baskets. A grazing grass.

**A. Galpinii**, Stapf.

Ben McDhui, 9900 ft., March, *Galpin*, 6915!

DISTRIBUTION: Endemic.

ANTHOXANTHUM, *Linn.***A. Ecklonii**, Stapf.

Leribe, *A. Dieterlen*, 219!

DISTRIBUTION: Queenstown. Stockenstroom. Komgha. Natal.

SESUTO: *Lethu*. Meaning unknown. The green leaves, which have a pleasant smell, are plaited into necklaces, and worn by women and girls.

**A. brevifolium**, Stapf.

Ben McDhui, 9000 ft., March, *Galpin*, 6884!

DISTRIBUTION: Endemic.

KOELERIA, Pers.

**K. cristata**, Pers.

Mountain slopes and plateau. 10-30 in. high, spikes greenish. Summer. *A. Dieterlen*, 388 !, 888 !; Van Reenen, 5-6000 ft., December, *Wood*, 7215a, 7215 !; Bushman's River Valley, 6-8000 ft. October, *Wood*, 10549 !; in grassy valleys and gorges, Wittebergen, 6-7000 ft., *Drège*.

DISTRIBUTION: Namaqualand Minor. Clanwilliam. Cape. Tulbagh. Bredasdorp. Swellendam. Mossel Bay. Knysna. Uitenhage. Port Elizabeth. Albany. Fort Beaufort. Graaff Reinet. Queenstown. Aliwal North. Stockenström. Komgha. Transkei. Tembuland. Natal. Orange Free State.

SESUTO: *Boshoane*. Small tumour. *Sesoeu sa thaba*. "Sesoeu" of the mountain. Used to make hats and baskets. Grazed by cattle.

**K. capensis**, Nees.

Ben McDhui, 9900 ft., March, *Galpin*, 6920.

This identification was given to Mr. Galpin by Dr. Stapf.

AVENASTRUM, Jess.

**A. turgidulum**, Stapf.

Veld. 10-36 in. high, spikes greenish. Summer. *A. Dieterlen*, 400 !, 753 !; Lef's Kloof on N.E. slopes of Leribe plateau, *Phillips*, 808 !; 828 !; Ben McDhui, 9700 ft., March, *Galpin*, 6902 !; Wittebergen, 4-5000 ft., *Drège*.

DISTRIBUTION: Queenstown. Aliwal North. Transkei. Tembuland. Natal. Transvaal (Wonderboom Poort).

SESUTO: *Litsa tsû pulumo*. Hair of the tail of the gnu. *Seboeane*. The hairy one. Use unknown.

**A. caffrum**, Stapf.

Plateau. Spikelets greenish. January *A. Dieterlen*, 967 !; Wittebergen, 7500 ft. *Drège*.

DISTRIBUTION: Endemic.

SESUTO: See *A. turgidulum*, Stapf.

PENTASCHISTIS, Stapf.

**P. Jugorum**, Stapf.

Wittebergen, 7-8000 ft., *Drège*.

DISTRIBUTION: Endemic.

**P. airoides**, Stapf.

Veld and mountain slopes. 3-8 in. high, spikes greyish. Summer and Autumn. *A. Dieterlen*, 190!

DISTRIBUTION: Namaqualand Minor. Van Rhynsdorp. Cape. Albany. Fort Beaufort. Fraserburg.

SESUTO: *Mafōle*. Meaning unknown. *Yoang ba Mohlaka*. The grass of the marsh. Mixed with parts of a snake (also called "Mafōle") a charm is prepared and the witch doctors with the aid of the divining bones can secure a prosperous journey to a traveller.

**P. basutorum**, Stapf., sp. nov.

Veld and mountain slopes. 10-30 in. high, spikelets yellowish. Summer. *A. Dieterlen*, 222!

DISTRIBUTION: Endemic.

SESUTO: *Motāla oa hlalo*. The neck of the hare. Use unknown.

## DANTHONIA, DC.

**D. MacOwanii**, Stapf.

Doodman's Krans Mountain, 9150-9650 ft., March, *Galpin*, 6903, 6904.

DISTRIBUTION: Somerset East.

**D. disticha**, Nees.

Witte Berg, near Harrismith, *Buchanan*, 260; rocky summit of the Wittebergen, 7500 ft., *Drège*; Doodman's Krans Mountain, 8500-9650 ft., March, *Galpin*, 6907, 6908, 6909.

DISTRIBUTION: Swellendam. Riversdale. Uitenhage. Alexandria. Albany. Queenstown. Somerset East. Graaff Reinet. Albert.

**D. purpurea**, Beauv.

Wittebergen, 7500 ft., *Drège*.

DISTRIBUTION: Queenstown.

**D. stricta**, Schrad.

Summit Barkly Pass, 6500 ft., *G. Rattray in Herb. Galpin*, 7333.

DISTRIBUTION: Clanwilliam. Cape. Paarl. Tulbagh. Worcester. Caledon. Riversdale. Mossel Bay. Beaufort West.

**D. subnervis**, Stapf.

In marsh at base of Doodman's Krans, 8500 ft., March. *Galpin*, 6906.

DISTRIBUTION: Endemic.



PHRAGMITES, *Trin.*

**P. communis**, *Trin.*

Water courses and marshes. Spikes whitish-grey. Summer–Autumn, *A. Dieterlen*, 256 !; Leribe, *Buchanan*, 122.

DISTRIBUTION: Cape. Worcester. Uitenhage. Albany. Queens-town. Somerst East. Graaff Reinet. Natal. Hope Town. Prieska. Orange Free State. Transvaal (near Lydenburg).

SESUTO: *Lehlaka*. Reed. Used for thatching and making the enclosures near the native huts. In time of famine the rhizomes are chewed. The Basutos believe that the human race sprung from a reed. They have a custom of placing a stem of this grass on the roof of the hut or in the “lelapa” (a circular courtyard surrounding the hut) when a female child is born, and two in the case of a male child. This is their method of informing the village folk of the event, and no man will dare enter the “lelapa” when such a sign is exhibited.

POLYPOGON, *Desf.*

**P. tenuis**, *Brongn.*

In cave on the Wittebergen, 6000 ft., *Drège*.

DISTRIBUTION: Cape. Tulbagh. Caledon. Uitenhage. Port Elizabeth.

AGROSTIS, *Linn.*

**A. bergiana**, *Trin.*

Mountain slopes, under a wet rock. 5–12 in. high. Spikes whitish. February. “Posa” Kloof, Leribe. *A. Dieterlen*, 842!

DISTRIBUTION: Clanwilliam. Cape. Tulbagh. Albany. Natal.

SESUTO: *Yoang ba phorora*. The grass of the waterfall. Used when working the divining bones.

**A. barbuligera**, *Stapf.*

Doodman’s Krans Mountain, 9000 ft., March, *Galpin*, 6914.

DISTRIBUTION: Somerset East. King William’s Town.

**A. lachnantha**, *Nees.*

River banks and mountain slopes. 6–40 in. high. Spikes greenish. Summer. *A. Dieterlen*, 197 !, 975 !; ravine on west slopes of Leribe plateau, *Phillips*, 591 !; Drakensbergen, near Harrismith, *Buchanan*, 119; in a cave, Wittebergen, 6000 ft., *Drège*.

DISTRIBUTION: Namaqualand Minor. Cape. Tulbagh. Uitenhage.

Albany. Cathcart. Queenstown. Graaff Reinet. Aliwal North. Natal. Griqualand West.

SESUTO: *Sesoemyana*. The small white one. *Sesoen*. The white one. *Chaōla* or *Chabōle*. The "blossom" of a sheaf of grass which burns without smoke. *Mo-hloa-mafika*. He who climbs up rocks. Derived from the verb "ho hloa"—to climb up. This grass is burnt in huts which have no outlet for smoke. The young shepherds use the grass for plaiting hats.

**A. eriantha**, Hack.

Van Reenen, 5-6000 ft., March, *Wood*, 5990.

DISTRIBUTION: Transvaal (Pretoria, Middleburg).

**A. subulifolia**, Stapf.

Ben McDhui, 9600 ft., March, *Galpin*, 6911.

DISTRIBUTION: Endemic.

**A. sp.?**

In marsh at base of Doodman's Krans Mountain, 8500 ft., March, *Galpin*, 6910.

DISTRIBUTION: Endemic.

CALAMAGROSTIS, *Roth*.

**C. epigeios**, *Roth*.

At the foot of the Wittebergen, 4500-5000 ft., *Drège*.

DISTRIBUTION: Swellendam. Hay.

ARISTIDA, *Nees*.

**A. Adscensionis**, Linn.

Veld and mountain slopes. 10-20 in high, spikes greyish. Summer. *A. Dieterlen*, 199b!; ravine on west slopes of Leribe plateau, *Phillips*, 638!, the slopes of the ravine are mostly covered with this grass; various localities on Leribe plateau and slopes, *Phillips*, 692!, 734!, 741!, 790!, 919!

DISTRIBUTION. Namaqualand Minor. Uitenhage. Ceres. Somerset East. Graaff Reinet. Calvinia. Albert. Griqualand West. Orange Free State (between Kimberley and Bloemfontein).

SESUTO: *Lefila*. A broom. *Mohlolohali*. A widow. Used for making brooms.

**A. angustata**, Stapf.

Between Tent Kop and Antelope Park, 5600 ft., March, *Galpin*, 6901.

DISTRIBUTION: Cape. Tulbagh. Worcester. Cathcart. Transvaal (Magaliesberg, Holfontein. Houtbosch, near Klippan).

**A. Burkei**, Stapf.

Veld and mountain slopes. 12–28 in. high, spikes greyish. Summer. *A. Dieterlen*, 199a!; Qoqolosi Peak, *Phillips*, 948!

DISTRIBUTION: Orange Free State (near the Vaal River, near Hoopstad).

SESUTO: *Lefiçilo*. A broom. Used for making brooms. A bunch of this grass is used for sprinkling sick persons with a certain medicine, and it is believed that by so doing the illness is swept away from the body, as a broom sweeps dust from a room.

**A. bipartita**, Rupr. & Trin.

Basutoland, *Buchanan*, 125.

DISTRIBUTION: Fort Beaufort. Somerset East. Natal. Orange Free State (Vaal River, Bloemfontein).

**A. congesta**, Roem. & Schult.

Veld. 15–24 in. high, spikes greenish. Autumn. *A. Dieterlen*, 383!; mountain slopes, south of the Mission Station, frequent, *Phillips*, 655!; south slopes of Leribe plateau above Khaniane, *Phillips*, 898!; Leribe, *Buchanan*, 149.

DISTRIBUTION: S.W. Africa. Uitenhage. Queenstown. Somerset East. Graaff Reinet. Colesberg. Albert. Natal. Prieska. Griqualand West. Orange Free State (Great Vet River, Bloemfontein). Transvaal (Lydenburg, Pretoria).

SESUTO: *Phutha-likhōba*. Gathered by lazy people. *Phutha-mahlasoa*. Gathered by careless people. Some of the natives, too lazy to search for *A. Adscensionis*, *A. Burkei* or *Eragrostis gummiflua*, Nees, which make good brooms, collect this grass instead for making brooms.

**A. vestita**, Thunb.

Basutoland, Leribe, *Buchanan*, 124.

DISTRIBUTION: Cape. Swellendam. Uitenhage. Alexandria. Cathcart. Queenstown. Prince Albert. Aberdeen. Somerset East. Graaff Reinet. Colesberg. Albert. Hay. Transvaal (Lydenburg, Potgieter's Rust, Aapie's River).

**A. Galpinii**, Stapf.

Ben McDhui, 9400 ft., *Galpin*, 6900.

DISTRIBUTION: Endemic.



**A. bergiana**, Trin. forma *rigidula*.

Summit of Doodman's Krans Mountain, 9650 ft., March, *Galpin*, 6913.

DISTRIBUTION: Endemic.

PEROTIS, *Ait.***P. latifolia**, Ait.

Van Reenen, 5-6000 ft., March, *Wood*, 5990.

DISTRIBUTION: Transvaal (Klippan).

TRAGUS, *Haller*.**T. racemosus**, All.

Mountain slopes. 6-13 in. high, spikes greyish. Summer. *A. Dieterlen*, 240!

DISTRIBUTION: Uitenhage. Albany. Queenstown. Wodehouse. Graaff Reinet. Albert. Natal. Griqualand West. Orange Free State (near Boshof).

SESUTO: *Mohloa-tšēpe*. Iron "mohla." Meaning unknown. *Mabele a litsoere*. Sorghum of the Cape canary. Good grazing grass for cattle and goats.

SPOROBOLUS, *R. Br.***S. discosporus**, Nees.

Plateau. 2-6 in. high, spikes cream and brown. Summer. Not common. *A. Dieterlen*, 660!; Thaba Unchu, *Burke*.

DISTRIBUTION: Colesberg. Aliwal North.

SESUTO: 'Ma-Motsofali. The mother of the old one (man or woman). *Mofaho oa linonyane*. The provisions of the birds. Use unknown.

**S. centrifugus**, Nees.

Plateau. 6-25 in. high, spikes brown. Summer. *A. Dieterlen*, 671!; Drakensbergen, near Harrismith, *Buchanan*, 17; Wittebergen, 4-6000 ft., *Drège*.

DISTRIBUTION: Cathcart. Tembuland. Griqualand East. Natal. Zululand.

SESUTO: *Mabèlè a linonyana*. Kaffir corn of the birds. Grazed by cattle.

var. **angustata**, Nees.

Van Reenen, 5-6000 ft., December, *Wood*, 7218.

DISTRIBUTION: Transkei. Zululand.

**S. fimbriatus**, Nees.

Sides of dongas. 20–36 in. high, spikes dark grey. March. *A. Dieterlen*, 880!

DISTRIBUTION: Uitenhage. Graaff Reinet. Somerset East. Colesberg. Natal. Griqualand West. Orange Free State (Winburg). Transvaal (near Lydenburg).

SESUTO: *Matolo a maholo*. The big knots in the stems. In time of famine the “seeds” are used to make a kind of pap. A grazing grass.

POGONARTHRIA, *Stapf*.

**P. falcata**, Rendle.

In a field, near the Caledon River. *A. Dieterlen*, 837!; Leribe, *Buchanan*, 128.

DISTRIBUTION: Natal. Griqualand West. Orange Free State (Oliphant's Fontein, Great Vet River, Bloemfontein). Transvaal (Bosch Veld, near Lydenburg).

SESUTO: *Mongoyane*. Little dampness.

DIPLACHNE, *Beauv.*

**D. Eleusine**, Nees.

Basutoland. Leribe, *Buchanan*, 232.

DISTRIBUTION: Fort Beaufort. Komgha. Tembuland. Transkei. Natal.

**D. fusca**, Beauv.

Basutoland. Leribe, *Buchanan*, 135.

DISTRIBUTION: Cape. Mossel Bay. Oudtshoorn. Uitenhage. Albany. Prince Albert. Somerset East. Graaff Reinet. Queens-town. King William's Town. Komgha. Griqualand West. Bechuanaland, Transvaal (Klippan, Oliphants' Poort).

**D. biflora**, Hack. var. **Buchanani**, Stapf.

Basutoland, Leribe, *Buchanan*, 219.

DISTRIBUTION: Endemic.

ERAGROSTIS, *Beauv.*

**E. caesia**, Stapf.

Mountain slopes. 15–26 in. high, spikes greyish. Autumn. *A. Dieterlen*, 779!; Leribe plateau, February, *A. Dieterlen*, 977a!; Ben McDhui, 9400 ft., March, *Galpin*, 6923.

DISTRIBUTION: Cathcart. Natal.



SESUTO: *Se-rata-majoe*. He who likes stones. *Molulana*. Meaning unknown. Used to plait hats and baskets.

**E. curvula**, Nees, var. *conferta*, Nees.

Leribe, *A. Dieterlen*, 352!; mountain slopes behind the Mission Station, *Phillips*, 501!, 506!, 547!, one of the principal grasses on the slopes; slopes south of the Mission Station, *Phillips*, 680!; ravine on west slopes of Leribe plateau, *Phillips*, 608!; south slopes of Leribe plateau, above Khaniane, *Phillips*, 926!, 930!; various localities, *Phillips*, 645!, 650!, 658!, 681!, 955!; near Buffalo River Waterfall, 8200 ft., *Galpin*, 6925.

DISTRIBUTION: Worcester. Swellendam? Knysna. Uitenhage. Port Elizabeth. Alexandria. Somerset East. Graaff Reinet. Colesberg. Wodehouse. Komgha.

SESUTO: *Matolo*. Is the singular form of "Letola" meaning knots (nodes?) in the stem of grasses and Cyperaceae. The fruits called "Moseka" were used by the Basutos in times of war and famine. When referring to those times they say, "When we lived on 'Moseka.'"

**E. lehmanniana**, Nees, var. *ampla*, Stapf.

Basutoland, Leribe, *Buchanan*, 141.

DISTRIBUTION: Endemic.

**E. chloromelas**, Steud.

Veld. 10-28 in. high; spikes greyish. Summer. *A. Dieterlen*, 216!; Qoqolosi Peak, *Phillips*, 945!; Van Reenen, 5-6000 ft., December, *Wood*, 7221.

DISTRIBUTION: Cathcart. Queenstown. Graaff Reinet. Somerset East. Wodehouse. Natal. Orange Free State. Transvaal (Houtbosch, near Potchefstroom).

SESUTO: *Seritsōane*. Meaning unknown. *Tlanyane*. Derived from the verb "ho tlanya"—to be fond of. A grass very much liked by cattle. The fruits were used as food in times of war and famine.

**E. nebulosa**, Stapf.

Leribe. *A. Dieterlen*, 317!; between Harrismith and Leribe, *Buchanan*, 209; De Beer's Pass, *Wood*, 5992; between Tent Kop and Antelope Park, 5400 ft. *Galpin*, 6921.

DISTRIBUTION: Swellendam. Riversdale. Natal. Orange Free State (Hoopstad). Transvaal (Magaliesbergen).

SESUTO: *Tsāne* (*tsēsane*). Thin. *Molelengoane*. Derived from the verb "ho lelemeha"—to weave, undulate or crouch on the ground when the wind blows. A grazing grass, and it is used to make ropes

and the big grain baskets ("lisin"). The fruits are used in times of famine to make a moderately good pap.

**E. micrantha**, Hack.

Near Leribe, *Buchanan*, 126.

DISTRIBUTION: Orange Free State (near Draaifontein).

**E. plana**, Nees.

Veld. 30–40 in. high, spikes greyish. Summer–Autumn. *A. Dieterlen*, 384!; the principal grass on the slopes of ravine, between the Mission Station and Jonathan's Village, *Phillips*, 566!, south slopes of Leribe plateau above Khaniane, *Phillips*, 899!, mountain slopes south of the Mission Station, common, *Phillips*, 643!, 649!; between Harrismith and Leribe, *Buchanan*, 216.

DISTRIBUTION: Queenstown. King William's Town. Transkei. Natal. Transvaal (near Lydenburg).

SESUTO: *Molula*. He who remains. Derived from the verb "ho lula"—to remain. *Mo-sita-tholo*. He who annoys the eland. A grazing grass, but not so much liked as some of the preceding species of *Eragrostis*. Used to make very strong baskets and hats, and is an ingredient in many strengthening medicines.

**E. denudata**, Hack.

Basutoland. Leribe, *Buchanan*, 132; near the Caledon River, *Burke*.

DISTRIBUTION: Griqualand West. Orange Free State (between Kimberley and Bloemfontein). Transvaal (near Klippan).

**E. chalcantha**, Trin.

Veld. 7–20 in. high, spikes grey. Summer. *A. Dieterlen*, 470!; Qoqolosi Peak, *Phillips*, 945!, 949!; De Beer's Pass, *Wood*, 5995; Van Reenen, 5–6000 ft., *Wood*, 7223; between Tent Kop and Antelope Park, 5800 ft., March, *Galpin*, 6924; Caledon River, near Commissie Drift, 4000 ft., *Burke*, 114, *Zeyher*, 1835.

DISTRIBUTION: Swellendam. Riversdale. Uitenhage. Alexandria. Albany. Queenstown. Stockenstrom. Komgha. Tembuland. Pondoland. Natal. Transvaal (Mooi River, near Pretoria, Aapie's River, Blauw Bank, near Lydenburg).

SESUTO: *Tsāne ea lithola*. The "tsane" (thin) of the plains. *Seritsvane sa lithola*. The "seritsvane" of the plains. A grazing grass.

**E. major**, Host.

Veld and gardens. 13-28 in. high, spikelets greenish-grey. Summer-Autumn. *A. Dieterlen*, 200!

DISTRIBUTION: Queenstown. Bathurst. Graaff Reinet. Hanover. Tembuland. Natal. Orange Free State (near Bloemfontein). Transvaal (near Lydenburg).

SESUTO: *Lehōla le letsō la lipère*. The black weed of the horses. A good grazing grass, much liked by horses and cattle. Said to have been introduced into Basutoland.

**E. brizoides**, Nees.

Veld, mountain slopes and plateau. 5-28 in. high, spikes yellow and reddish-brown. Summer. *A. Dieterlen*, 183!, 665!; mountain slopes behind the Mission Station, *Phillips*, 507!, slopes of ravine between the Mission Station and Jonathan's Village, *Phillips*, 565!, 573!; south slopes of Leribe plateau above Khaniane, *Phillips*, 879!; base of ravine on west slopes of Leribe Plateau, *Phillips*, 644!; Van Reenen's Pass, 5-6000 ft., December, *Wood*, 7222, 7245; sandy places at the foot of the Wittebergen, 5000 ft., *Drège*.

DISTRIBUTION: Clanwilliam. Cape. Tulbagh. Paarl. Stellenbosch. Caledon. Swellendam. Riversdale. Uniondale. Bathurst. Port Elizabeth. Humansdorp. Uitenhage. Albany. Alexandria. Stockenström. Cathcart. Jansenville. Graaff Reinet. Aliwal North. Transkei. Tembuland. Natal. Transvaal (Klipdrift, Spitzkop, Aapie's River).

SESUTO: *La Baroa*. The grass of the bushman. Burnt in cultivated lands in autumn with the belief that the smoke will hasten the ripening of the corn. Shepherd boys play with it. A grazing grass. In the specimens No. 183 the spikelets are from .8-1 cm. long and contain many florets; in No. 665 the spikelets are .4-.5 cm. long with few florets; but mounted on the sheet of No. 183 is a specimen which bears both kinds of spikelets, thus connecting the two extreme forms.

**E. truncata**, Hack.

Basutoland, Leribe, *Buchanan*, 130.

DISTRIBUTION: Graaff Reinet. Griqualand West. Bechuanaland.

**E. gummiflua**, Nees.

Veld and mountain slopes. 18-40 in. high. spikelets reddish-yellow. Summer-Autumn. *A. Dieterlen*, 225!; mountain slopes behind the Mission Station, *Phillips*, 508!; ravine on west slopes of Leribe Plateau, *Phillips*, 696!; near Leribe, *Buchanan*, 140.

DISTRIBUTION: Uitenhage. Humansdorp. Uniondale. Queens-town. Komgha, Transkei. Natal. Transvaal (Bosch Veld, Rustenburg, Dwars River).

SESUTO: *Thitapoho*. Strong as a bull (referring to the plant being strongly rooted). Makes good strong brooms. Native doctors use this plant as an ingredient in medicines for keeping or bringing luck.

### CYNODON, Pers.

#### *C. dactylon*, Pers.

Veld and mountain slopes. 5-10 in. high, spikelets greyish. Summer. *A. Dieterlen*, 220! Common.

DISTRIBUTION: Namaqualand Minor. Van Rhynsdorp. Cape. Tulbagh. Uitenhage. Port Elizabeth. Queenstown. Somerset East. Transkei. Natal. Orange Free State (between Kimberley and Bloemfontein). Bechuanaland. Transvaal (Houtbosch and Lydenburg).

SESUTO: *Mohloa*. Meaning unknown. *Morara*. Creeper. A good grazing grass for horses and cattle. A medicine called "morarollo" is prepared from this by the native doctors by means of which they are supposed to be able to solve a difficult matter. This grass, together with fruits of the Kaffir-corn, sugar-cane, the seeds of a pumpkin, water-melon, and a kind of native pumpkin called "Mokopuntja," is put in a grave when a Basuto is buried. *Mokopu-ntja* means "the pumpkin of a dog," but up to now no specimens of it have been obtainable.

### MICROCHLOA, R. Br.

#### *M. caffra*, Nees.

Stony places on veld. 5-18 in. high, spikes brownish-grey. Summer. *A. Dieterlen*, 534!

DISTRIBUTION: Tulbagh. Uitenhage. Cathcart. Albany. Somerset East. Tembuland. Natal. Transvaal (Incomate River).

SESUTO: *Yoang ba matlapa*. The grass of the flat stones.

### HARPECHLOA, Kunth.

#### *H. capensis*, Kunth.

Veld, mountain slopes and plateau. 8-20 in. high, spikes dark grey. Spring and Summer, common. *A. Dieterlen*, 355!; ravine on west slopes of Leribe plateau, occasional, *Phillips*, 611!, 717!; Qoqolosi Peak, *Phillips*, 969!; summit Doodman's Krans Mountain, 9650 ft. *Galpin*, 6918.

DISTRIBUTION: Swellendam. Uniondale. Uitenhage. Port Elizabeth. Alexandria. Albany. Queenstown. Somerset East. Graaff Reinet. Stockenström. Tembuland. Natal. Orange Free State. Transvaal (Spitkop).

SESUTO: *Marapshane*. Meaning unknown. *Marotlo a lithota*. The "Marotlo" of the plains. The inflorescence is called a "Mothene" crown, and is plaited and worn as a crown by children. A grazing grass much liked by cattle.

### CHLORIS, Sw.

#### *C. virgata*, Swartz.

Veld, gardens and roadsides. 10–30 in. high, spikes whitish. Summer–Autumn. *A. Dieterlen*, 428!; Caledon River, *Burke*, 429; Thaba Unchu, *Burke*; Van Reenen, 5–6000 ft., *Wood*, 5990.

DISTRIBUTION: Uitenhage. Queenstown. Aberdeen. Graaff Reinet. Colesberg. Richmond. Albert. Herbert. Komgha. Transkei. Natal. Orange Free State (near Oliphant's Fontein). Transvaal (near Lydenburg).

SESUTO: *Schabane*. Meaning unknown.

#### *C. petraea*, Thunb.

Mountain slopes. 6–33 in. high, spikes brown. Summer–Autumn. Uncommon. *A. Dieterlen*, 564!; mountain slopes behind the Mission Station, *Phillips*, 548!

DISTRIBUTION: Caledon. Riversdale. Uitenhage. Alexandria. Albany. Queenstown. Graaff Reinet. Albert. Hay. Tembuland. Natal. Orange Free State. Bechuanaland.

SESUTO: *Sebokunyana*. The small "Seboku." Meaning unknown.

### ELEUSINE, Gaertn.

#### *E. indica*, Gaertn.

Veld and mountain slopes. 6–20 in. high, spikes greenish. Summer. *A. Dieterlen*, 226!

DISTRIBUTION: Cape. Albany. Komgha. Tembuland. Natal. Transvaal (Johannesburg). Delagoa Bay.

SESUTO: *Moseli*. Derived from the verb "ho sela"—to look for food. *Monyakhomo*. Meaning not quite clear, but it may mean that the "Khome" (cattle) remain behind to eat it, cattle being very fond of this plant. The fruits eaten in time of famine.



CROSSOTROPIS, Stapf.

**C. grandiglumis**, Rendle.

Leribe. *A. Dieterlen*, 531!; between the Wittebergen and Kraai River, 4500–5000 ft., *Drège*; Caledon River, *Burke*, 228; Commissie Drift on Caledon River, *Zeyher*, 1844.

DISTRIBUTION: Albert. Hay. Natal. Orange Free State (near Winburg). Transvaal (near Rustenburg, near Nylstroom). Bechuanaland.

SESUTO: *Yoang ba tsela*. The grass of the road. Some natives say it is somewhat poisonous. Used by the witch-doctors, and is supposed to bring harm.

ENNEAPOGON, Desv.

**E. scoparius**, Stapf.

Stony spots on the mountain slopes. 12–22 in. high, spikes greyish. Summer. *A. Dieterlen*, 598!

DISTRIBUTION: Graaff Reinet. Colesberg. Philipstown. Albert. Orange Free State. Transvaal (Klippan).

SESUTO: *Yoang ba mafika*. The grass of the rocks. *Lefiñlo*. A broom. Used to make brooms. See also *Aristida Adscensionis* and *A. Burkei*.

LEERSIA, Sw.

**L. hexandra**, Sw.

Water courses. 2–4 ft., high, spikes pinkish-grey. Summer–Autumn, *A. Dieterlen*, 683!

DISTRIBUTION: Robertson. George. Uitenhage. Albany. Komgha. Tembuland. Natal. Orange Free State (near Winburg). Transvaal (near Lydenburg).

SESUTO: *Mohlakana*. Small marsh. *Mahlakamane a manyenyane*. The small “Mahlakamane.” A grazing grass.

EHRHARTA, Thunb.

**E. erecta**, Lamk.

Damp sandy spots on mountain slopes. 10–20 in. high, spikes whitish green. Spring–Autumn. *A. Dieterlen*, 395!; Wittebergen, *Drège*.

DISTRIBUTION: Cape. Paarl. Swellendam. Riversdale. Mossel Bay. George. Port Elizabeth. Alexandria. Prince Albert. Somerset East. Graaff Reinet. Albert. King William’s Town. Komgha. Tembuland. Orange Free State (Bloemfontein).

SESUTO: *Khōlane*. Small "lehola." "Lehola" is the native name for all kinds of weeds.

**E. calycina**, Sm.

Basutoland, Leribe, *Buchanan*, 218; near the Buffalo River Waterfall, 7900 ft., *Galpin*, 6919.

DISTRIBUTION: Namaqualand Minor. Van Rhynsdorp. Clanwilliam. Malmesbury. Cape. Tulbagh. Swellendam. Uitenhage. Port Elizabeth. Albany. Prince Albert. Natal.

PHALARIS, *Linn.*

**P. arundinacea**, Linn.

Van Reenen, 5-6000 ft., December, *Wood*, 7215 partly; at the foot of the Wittebergen, 4500-5000 ft., *Drège*.

DISTRIBUTION: Van Rhynsdorp. Malmesbury. Cape. Mossel River. Uitenhage. Port Elizabeth. Albany. Tembuland.

MELICA, *Linn.*

**M. bolusii**, Stapf.

Summit Doodman's Krans Mountain, 9650 ft., *Galpin*, 6926

DISTRIBUTION: Graaff Reinet.

**M. racemosa**, Thunb.

Stony places on mountain slopes. 12-20 in. high, spikes greenish. Summer. *A. Dieterlen*, 796!; without precise locality, *Cooper*, 3358.

DISTRIBUTION: Cape. Riversdale. Uitenhage. Port Elizabeth. Alexandria. Albany. Queenstown. Middelburg. Stockenström. King William's Town. Komgha. Tembuland. East Griqualand. Natal.

SESUTO: *Ntlo ea thaba e nyenyane*. The small house of the "Bishop" bird. *Ntlo ea motinyane e nyenyane*. The small house of the grass warbler or wren. These birds use part of the inflorescence to build their nests with.

**M. decumbens**, Thunb.

Stony places on mountain slopes. 10-20 in. high, spikes whitish. Summer and Autumn. *A. Dieterlen*, 556!

DISTRIBUTION: Fort Beaufort. Queenstown. Somerset East. Graaff Reinet. Albert? Orange Free State.

SESUTO: See *M. racemosa*, Thunb.

FINGERHUTHIA, *Nees*.

**F. africana**, *Lehm.*

Basutoland, Leribe, *Buchanan*, 129.

DISTRIBUTION: Namaqualand Minor. Van Rhynsdorp. Riversdale. Oudtshoorn. Prince Albert. Graaff Reinet. Ceres. Fraserburg. Griqualand West.

STIBURUS, *Stapf*.

**S. alopecuroides**, *Stapf*.

Plateau, 8–18 in. high, spikes purplish. April–May. *A. Dieterlen*, 886!; De Beer's Pass, *Wood*, 5993; Antelope Park, 5900 ft., *Galpin*, 6927; summit Barkly Pass, 6500 ft., *Rattray in Herb. Galpin*, 7332.

DISTRIBUTION: Pondoland. East Griqualand. Natal.

SESUTO: *Morakela*. He who comes first.

**S. Conrathii**, *Hack.*

Plateau, 5–20 in. high, spikes pinkish-grey. Spring. *A. Dieterlen*, 807!

DISTRIBUTION:

SESUTO: *Mohloëla*. He who spies.

LASIOCHLOA, *Kunth*.

**L. longifolia**, *Kunth*.

Summit Barkly Pass, 6500 ft., *Galpin*, 7331.

DISTRIBUTION: Cape. Paarl.

TETRACHNE, *Nees*.

**T. Dregei**, *Nees*.

Mountain slopes and banks of rivers. 30–40 in. high, spikes greyish. Summer. *A. Dieterlen*, 579!; Leribe, *Phillips*,!; Wittebergen, 4500–5000 ft., *Drège*.

DISTRIBUTION: Queenstown. Colesberg. Graaff Reinet. Albert, Hope Town.

SESUTO: *Thitapoho e nyenyane*. The small “Thitapoho.” See also *Eragrostis gummiiflua*, *Nees*. Used by the witch-doctors for protecting people and villages in time of war and danger.

POA, *Linn.*

**P. binata**, *Nees*.

Damp and shady spots on mountain slopes. 12–20 in. high, spikes greenish. Summer. Common. *A. Dieterlen*, 668!; Drakensbergen.

near Harrismith, *Buchanan*, 116; Ben McDhui, 9650 ft., March, *Galpin*, 6916.

DISTRIBUTION: Albany. Cathcart. Queenstown. Komgha. Tembuland. Natal.

SESUTO: *Lehōla*. A weed. *Yoang ba lintja*. The grass of dogs. A good grazing grass.

**P. annua**, Linn.

Damp spots on mountain slopes. 5-16 in. high, spikes greyish. Spring-Autumn. Common. *A. Dieterlen*, 730!

DISTRIBUTION: Cape. Albany. Natal.

SESUTO: See *P. binata*, Nees.

FESTUCA, *Linn.*

**F. caprina**, Nees.

Mountain slopes and plateau. 16-30 in. high, spikes greenish. Summer. Common. *A. Dieterlen*, 399!; Doodman's Krans Mountain, Ben McDhui, etc.; 8600-9900 ft., *Galpin*, 6885.

DISTRIBUTION: Queenstown. King William's Town. Orange Free State.

SESUTO: *Boleane*. The smooth one. *Letsuiri*. Meaning unknown. Used for making ropes and hats. Also put under skins which are being worked to make them supple.

var. **macra**, Stapf.

Witteberg, near Harrismith, *Buchanan*, 262.

DISTRIBUTION: Endemic.

**F. longipes**, Stapf.

Veld and mountain slopes. 13-38 in. high, spikes greenish. Summer. *A. Dieterlen*, 503!

DISTRIBUTION: Albany. Komgha. King William's Town. Stockenstroom. Tembuland.

SESUTO: *Lekoloyane*. Meaning unknown.

**F. scabra**, Vahl.

Leribe, *A. Dieterlen*, 704!; Ben McDhui, 9600 ft., March, *Galpin*, 6928; Wittebergen, 7-7500 ft., *Drège*.

DISTRIBUTION: Namaqualand Minor. Cape. Paarl. Worcester. Tulbagh. Stellenbosch. Caledon. Swellendam. Riversdale. Mossel Bay. George. Uitenhage. Albany. Graaff Reinet. Komgha. Tembuland. East Griqualand. Natal. Orange Free State.

SESUTO: *Serakoe*. Derived from the verb "ho raka"—to come first. *Mabèlè a litsoere*. The Sorgho (Kaffir-corn) of the Cape canary.

**F. sp.**

Plateau. Spikes greenish. Summer. *A. Dieterlen*, 916!

DISTRIBUTION: Endemic?

SESUTO: *Lekoloyane*. Meaning unknown.

Dr. Stapf reports "*Festuca*, near *F. costata*, but ovary glabrous. Material insufficient."

BROMUS, *Linn.*

**B. leptoclados**, Nees.

Veld and mountain slopes. 30-44 in. high, spikes greenish. Summer. *A. Dieterlen*, 756!; ravine on west slopes of Leribe plateau, occasional, *Phillips*, 607!; near Leribe, *Buchanan*, 222; Kraai River, 4-5000 ft., *Drège*.

DISTRIBUTION: Cape. Swellendam. Bedford. Natal.

SESUTO: *Lehōla*. A weed. Grazed by cattle and horses, and makes good hay. Said by the natives to have been introduced into Basutoland.

**B. speciosus**, Nees.

Leribe plateau. Spikes greenish. February. *A. Dieterlen*, 977!; summit of Drakensbergen between Doodman's Krans and Satsanna Berg, 8600-9550 ft., *Galpin*, 6905.

DISTRIBUTION: Queenstown. King William's Town.

SESUTO: *Yoang ba lintja*. The grass of dogs. Grazed by cattle.

Dr. Stapf, who kindly examined the specimen, reports: "Status foliis latis planis paniculae ramis scaberuli, sed vix varietatis titulo dignus."

**B. firmior**, Stapf. var. *leiorhachis*, Stapf.

Witteberg, near HarriSmith, *Buchanan*, 265.

DISTRIBUTION: King William's Town.

**B. uniloides**, H.B.K.

Leribe. 12-20 in. high, spikes green. Summer. *A. Dieterlen*, 251 A and B!

DISTRIBUTION: Cape. Port Elizabeth. Albany. Queenstown. Natal. Transvaal (near Pretoria, near Lydenburg).

SESUTO: *Lehola*. A weed. *Yoang ba lintja*. The grass of the dogs. A good grazing grass and makes good hay. The natives believe this grass to have been introduced into Basutoland.



## BRACHYPODIUM, Beauv.

**B. flexum**, Nees.

On the Witteberg, near Harrismith, *Buchanan*, 261, 264.

DISTRIBUTION: Cape. Swellendam. Uitenhage. Somerset East. Transvaal (Houtbosch).

var. **tenue**, Stapf.

In Pot River Berg forest, 5500 ft., March, *Galpin*, 6887.

DISTRIBUTION: Natal.

**B. Bolusii**, Stapf.

Near Buffalo River Waterfall, 8150 ft., March, *Galpin*, 6929; Satsanna Berg, 9250 ft., March, *Galpin*, 6930.

DISTRIBUTION: Graaff Reinet.

## HORDEUM, Linn.

**H. secalinum**, Schreb.

Mountain slopes. 8-25 in. high, spikes greenish. Summer. *A. Dieterlen*, 783!; Kraai River, *Drège*.

DISTRIBUTION: Namaqualand Minor. Malmesbury. Cape. Swellendam. Queenstown. Graaff Reinet. Victoria West. Albert. Orange Free State.

SESUTO: *Litse ba ntja*. Hair of a dog's tail.

## ARUNDINARIA, Michx.

**A. tessellata**, Munro.

Mountain slopes and banks of water-courses, Leribe Kloof, *A. Dieterlen*, 279!; under trees in ravine on west slopes of Leribe plateau, plentiful, but browsed down by goats, *Phillips*, 751!; Oliver's Hoek, 5-6000 ft., January, *Wood*, 3668; shady places near Van Reenen, 8000 ft., *Schlechter*, 6997; near Buffalo River Waterfall, 8-9000 ft., and source of the Tina River, Drakensbergen, 8700 ft., March, *Galpin*, 6931; Wittebergen, in rocky moist valleys, 5-6000 ft., *Drège*; Basutoland, without precise locality, *Cooper*, 922.

DISTRIBUTION: Queenstown. Stockenström.

SESUTO: *Legala*. Meaning unknown. Used for spear handles and as laths for thatched roofs, but specially used for building the entrance to the "Lelopa," the reed enclosure round native huts.

## ZEA, Linn.

**Z. Mais**, Linn.

Cultivated. *A. Dieterlen*, 562.

DISTRIBUTION: Commonly cultivated throughout South Africa.

SESUTO: *Poone mealie*. This together with *Andropogon sorghum* var. *vulgare*, forms the principal food of the Basutos. The natives believe it to have been introduced from Zululand.

DESCHAMPSIA, *P. Beauv.*

*Deschampsia caespitosa*, *P. Beauv.* var. ?

Doodman's Kraus Mountain, 8500 ft., March, *Galpin*, 6917.

Gramineae (genus ?)

Mountain slopes and plateau. *A. Dieterlen*, 845!

This specimen was referred to Dr. Stapf, who reports, "I do not know any *Pentascistis*, *Pentameris* or *Danthonia* with ligules like those of this plant."

SESUTO: *Mosea* or *Moscha*. He cuts. Strong ropes, woven into baskets, are plaited from this grass.

PTERIDOPHYTES.

FILICES.

GLEICHENIA, *Smith.*

*G. polypodioides*, *Smith.*

Under rocks on mountain slopes. 2-12 in. high. Spring-Autumn. *A. Dieterlen*, 607!

DISTRIBUTION: Cape. Worcester. Tulbagh. Caledon. Riversdale. Uitenhage. Albany. King William's Town. Natal. Orange Free State (Rouxville). Transvaal (Magaliesberg, Rustenburg).

SESUTO: *Phalatsane*. Derived from the verb "ho phalatsa"—to grope for something in a careless manner and not knowing exactly where it is. *Lehōrōmetso*. Derived from the verb "ho hōrōmetso"—to cause (something) to be poured on the ground. *Pata-leoana*. Hide the small cave. *Iepata-maoa*. The hider of the small caves. The last three names are in general use for all ferns.

*G. umbraculifera*, *Moore.*

Drakensberg, at Cathkin Peak (*ex Sim*).

DISTRIBUTION: Tembuland. Stutterheim. King William's Town. Natal. Transvaal (near Lydenburg, Pilgrim's Rest).

## CYATHEA, Sm.

**C. Dregei**, Kunze.

Natal, Drakensbergen, *McKen*; *Buchanan*.

DISTRIBUTION: Stockenstroom. Stutterheim. Pondoland. Natal. Transvaal (Magaliesberg, MacMac).

## WOODSIA, Br.

**W. burgessiana**, Gerr.

Natal, Cathkin Peak, *Buchanan*; in Pot River Berg Forest, 5500 ft., March, *Galpin*, 6932.

DISTRIBUTION: Eastern Province and Transvaal.

## DAVALLIA, Smith.

**D. concinna**, Schrad.

Natal, Cathkin Peak, *McKen*.

DISTRIBUTION: Knysna. George. Albany. Stockenstroom. Transkei. Natal. Transvaal (Houtbosch).

## CYSTOPTERIS, Bernh.

**Cystopteris fragilis**, Bernh.

Mountain slopes on wet rocks. 3-12 in. high. Summer. *A. Dieterlen*, 795!; Natal, Drakensberg, *Wood*.

DISTRIBUTION: Stockenstroom. King William's Town. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*, Smith. The rhizomes of the plant, from which a decoction is prepared and given as an enema, are employed as a vermifuge. Frequently the rhizomes of *Lomaria punctulata*, *Asplenium furcatum*, *A. adiantum-nigrum*, *A. cuneatum* and *Pellaea calomelanos* are used together with the above.

## ADIANTUM, Linn.

**A. reniforme**, Linn. var. *asarifolium*, Willd.

Drakensberg, near Mont-aux-Sources. See *Wood's Natal List*.

**A. Capillus-Veneris**, Linn. var. *minor*.

Under rocks, shady and wet places. 3-12 in. high. Autumn. *A. Dieterlen*, 694!

DISTRIBUTION: Cape. Worcester. Albany. Port Elizabeth. Graaff Reinet. Stutterheim. Komgha. Transkei. Natal.

SESUTO: *Lepata-maoa*. *Pata-leoana*. See *Gleichenia polypodioides*.

The dried leaves are smoked as a cure for colds in the chest and head. The leaves are placed in a hole in the ground; the native, lying flat on the ground, inhales the smoke from another hole connected with the first by a shallow underground channel. "Dagga" is smoked in a similar way.

**A. aethiopicum**, Linn.

Mountain slopes. 3-15 in. high. Autumn *A. Dieterlen*, 73!; under rocks in ravines, *Phillips*, 593!; Natal, Drakensberg, *McKen*.

DISTRIBUTION: Bedford. Albany. Somerset East. Graaff Reinet. King William's Town. Natal.

SESUTO: *Pata-leoana*. *Lepata-maoa*. See *Gleichenia polypodioides*. See also note under *A. Capillus-Veneris*. The rachis of the leaf is woven into the grass hats of shepherds as an ornament.

CHEILANTHES, Sw.

**C. hirta**, Swartz.

Under rocks and shady places on mountain slopes. 5-20 in. high. Autumn-Summer. *A. Dieterlen*, 264a!, 264b!; under rocks, *Phillips*, 602!

DISTRIBUTION: Common throughout South Africa.

SESUTO: *Ma Mavaneng*. The mother in the caves. *Lehōrōmetso*. See *Gleichenia polypodioides*. A decoction prepared from the plant is drunk to relieve colds and sore throat. Formerly the plant was used alone: now the natives add some ginger. Other ferns are used for a similar purpose, but this species is said to be the best.

PELLAEAE, Link.

**P. consobrina**, Hook.

Mountain slopes. 10-30 in. high. Summer. *A. Dieterlen*, 68!; Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Knysna. Albany. Somerset East. Graaff Reinet. King William's Town. Komgha. Natal. Transvaal (Pilgrim's Rest).

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. The crushed rhizomes are cooked, and the decoction is injected into the vagina of a cow that has not got rid of all the after-birth in calving. It is this use of the plant which has given to so many ferns the native name "Lehōrōmetso."

**P. involuta**, Baker.

Under rocks on mountain slopes. 4-11 in. high. Summer. *A. Dieterlen*, 637!

DISTRIBUTION: Namaqualand Minor. Graaff Reinet. Komgha. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris*. Mosokelo. A medicine to cure diarrhœa. For diarrhœa and the bites of spiders the rhizome is crushed, mixed with milk, and drunk.

**P. hastata**, Link.

Mountain slopes in crevices of rocks. 6–20 in. high, sporeing in Autumn. *A. Dieterlen*, 546!

DISTRIBUTION: Common throughout South Africa.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris*.

**P. calomelanos**, Link.

Mountain slopes. 2–8 in. high. Summer. *A. Dieterlen*, 67!; under rocks and in caves. Summer. *A. Dieterlen*, 638!; under rocks, frequent, *Phillips*, 517!; Natal, Drakensberg. See *Wood's Natal List*.

DISTRIBUTION: S.W. Africa. Cape Province. Natal. Orange Free State. Transvaal.

SESUTO: *Lepato-maqa*. *Pata-Leoana*. *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris* and *Cystopteris fragilis*.

PTERIS, Linn.

**P. longifolia**, Linn.

Near the Caledon River, at the side of a rock. 7–25 in. high. February. Qalo. *A. Dieterlen*, 799!; Cathkin Peak. See *Sim's Ferns of South Africa*.

DISTRIBUTION: Uitenhage. Komgha. Natal. Transvaal (Magaliesberg, MacMac, Pretoria, Aapie's River).

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*.

**P. Cretica**, Linn.

Damp shady spots on mountain slopes. 6–25 in. high. Summer. *A. Dieterlen*, 282!; under rocks in ravines, *Phillips*, 594!

DISTRIBUTION: Swellendam. Knysna. George. Uitenhage. Bedford. Somerset East. King William's Town. Komgha. Transkei. Natal. Transvaal (Magaliesberg).

SESUTO: *Lesira*. A veil. *Lehōrōmetso*. See *Gleichenia polypodioides*. A charm to protect native warriors during battle. Before proceeding to fight, the warrior must bathe his whole body, early in



the morning, with water in which the crushed green plant has been placed. The fronds are also tied to the head-gear, so that they hang down like a veil, and act as a charm against the enemy's bullets.

**P. Buchanani**, Baker.

In caves on mountain slopes. 12-35 in. high. Autumn. *A. Dieterlen*, 761!

DISTRIBUTION: Knysna. King William's Town. Transkei. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Pellaea consobrina*.

**P. aquilina**, Linn.

Rocky places on mountain slopes. 10-30 in. high. Autumn. *A. Dieterlen*, 69!; 69b!

DISTRIBUTION: Very common throughout South Africa

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*.

LOMARIA, Willd.

**L. inflexa**, Kuntze.

Natal, Cathkin Peak, *Buchanan*, *Wood*.

DISTRIBUTION: King William's Town.

**L. punctulata**, Kze.

Under rocks on mountain slopes. 4-14 m. high. Summer. *A. Dieterlen*, 72!; Natal, Drakensbergen. See *Sim's Ferns of South Africa*.

DISTRIBUTION: Cape. Port Elizabeth. Albany. Pondoland. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Cystopteris fragilis*.

ASPLENIUM, Linn.

**A. trichomanes**, Linn.

Damp spots in ravines and on mountain slopes at foot of a waterfall. 2-6 in. high. Autumn. *A. Dieterlen*, 569!; 820!; in the shade of ravines, *Phillips*, 745!

DISTRIBUTION: Swellendam. Tulbagh. Bedford. Murraysburg. Graaff Reinet. Somerset East. Molteno. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris*.

**A. monanthemum**, Linn.

Rocks on mountain slopes. 3-7 in. high. Summer. *A. Dieterlen*, 710!; Natal, Drakensberg, *Buchanan*, *Wood*.

DISTRIBUTION: Cape. Swellendam. Knysna. Albany. Somerset East. Bedford. Stutterheim. King William's Town. Transkei.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris*.

**A. varians**, Hk. & Gr.

Natal, Cathkin Peak, *Buchanan*.

DISTRIBUTION: Bedford. Somerset East. Stockenström. King William's Town. Komgha. Natal.

**A. protensum**, Schrad.

Natal. Drakensbergen. *Buchanan*.

DISTRIBUTION: Knysna. Albany. Somerset East. Stockenström. King William's Town.

**A. adiantum-nigrum**, Linn.

Under rocks on mountain slopes. 3-9 in. high. Summer. *A. Dieterlen*, 241!

DISTRIBUTION: Cape. Swellendam. Tulbagh. Albany. Graaff Reinet. Somerset East. Cathcart. Alice. Stutterheim. Komgha. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Cystopteris fragilis*.

**A. cuneatum**, Linn.

Banks of Caledon River. 2-4 in. high. *A. Dieterlen*, 914!

DISTRIBUTION: Albany. Somerset East. King William's Town. Natal.

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Cystopteris fragilis*.

**A. furcatum**, Thunb.

Under rocks and shady places on mountain slopes. 5-13 in. high. Autumn. *A. Dieterlen*, 476!; Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Cape. Paarl. Uitenhage. Port Elizabeth. Bedford. Stutterheim. Transvaal (Magaliesberg).

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Cystopteris fragilis*.

**A. aspidioides**, Schl.

Basutoland, without precise locality. *Barkley*; Ben McDhui, 9550 ft., March, *Galpin*, 6936.

DISTRIBUTION: Natal.

**A. sp.**

Under a rock, near Matsoeberane's Village near Hlehoeng. April.

*A. Dieterlen*, 992b !

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*.

ASPIDIUM, *R. Br.*

**A. aculeatum**, Sw., var. **pungens**, Klf.

Under rocks on mountain slopes. 3-20 in. high, Summer. *A. Dieterlen*, 695 ! ; under rocks in ravines, *Phillips*, 588 ! ; 592 ! ; Natal, Drakensbergen, see *Wood's Natal List* ; Ben McDhui, 9350-9550 ft., March, *Galpin*, 6934, 6939.

DISTRIBUTION : Common throughout South Africa.

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*. A decoction prepared from the rhizomes is used as a vernifuge in humans and for "bots" in horses. In both cases it is given as an enema.

**A. falcatum**, Swartz.

Mountain slopes. 10-20 in. high. *A. Dieterlen*, 826 ! ; Natal, Drakensberg, *McKen* ; Cathkin Peak, *Buchanan*.

DISTRIBUTION : Somerset East. Stockenstroom. Transvaal. (MacMac).

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*.

NEPHRODIUM, *Rich.*

**N. thelypteris**, Desv.

At side of rocks on banks of dongas. 6-18 in. high. *A. Dieterlen*, 700 !

DISTRIBUTION : Worcester. Cape. Paarl. Tulbagh. Swellendam. Uitenhage. Albany. Somerset East. Komgha. Natal.

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Pellaea consobrina*.

**N. inaequale**, Hook.

Mountain slopes and dongas. 6-40 in. high. Summer-Autumn. *A. Dieterlen*, 283 !

DISTRIBUTION : Swellendam. Albany. Bedford. King William's Town. Komgha. Natal.

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Pellaea consobrina*.

**N. athmanticum**, Hook.

Shady spots on slopes and in dongas. 1-4 ft. high. Summer. *A. Dieterlen*, 167 !

DISTRIBUTION : Pondoland. Tembuland. Natal. Transvaal (MacMae, Magaliesberg).

SESUTO : *Lehōrōmetso*. See *Gleichenia polypodioides*. *Koma-Koma*. To grumble (an allusion to the noise the enema makes in the intestine). The species is the most esteemed of the ferns, used as described in the note under *Pellaea consobrina*. This is a plant the Basutos call "Mong a lebitso"—"The owner of the name or the one for whom the name has originated," as the general name for all ferns, viz., "*Lehōrōmetso*" was first applied to this species.

**N. sp.**

Ben McDhui, 9550 ft., March, *Galpin*. 6938.

**N. sp. ?**

Ben McDhui, 9550 ft., March, *Galpin*, 6937.

#### POLYPODIUM, Linn.

**P. vulgare**, Linn.

Natal. Drakensbergen. See *Wood's Natal List*; Orange Free State, Nelson's Kop, *Wood*.

DISTRIBUTION : Cape. George. Bedford. Albany. Somerset East. Graaff Reinet. King William's Town.

**P. incanum**, Swartz.

Natal, Van Reenen's Pass, *Rehmann*, 7209.

DISTRIBUTION : Knysna. Uitenhage. Bedford. Albany. King William's Town. Komgha. Transkei. Natal. Transvaal (MacMae).

**P. lanceolatum**, Linn.

Growing in moss on mountain slopes.  $2\frac{1}{2}$ –9 in. high. Spring (October). Makokoane, Leribe District, *A. Dieterlen*, 812!; Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION : Cape. Swellendam. George. Knysna. Uitenhage. Albany. Stutterheim. Komgha. Tembuland. Natal.

SESUTO : *Lehōrōmetso*. See note under *Cheilanthes hirta*.

#### NOTHOCHLAENA, Br.

**N. eckloniana**, Kze.

Mountain slopes, near or under rocks. 2–12 in. high. Spring–Summer. *A. Dieterlen*, 81!, 608!; Natal, Cathkin Peak, *Buchanan*.

DISTRIBUTION : Clanwilliam. Cradock. Middleburg. Uitenhage. Fort Beaufort. Stockenstrom. Stutterheim. King William's Town. Komgha. Natal. Transvaal (Magaliesberg, Trigard's Fontein).

SESUTO : *Lehōrōmetso*. See note under *Adiantum Capillus-Veneris*.

GYMNOGRAMME, Desd.

**G. cordata**, Schl.

Under rocks on mountain slopes. 3-9 in. high. Autumn. *A. Dieterlen*, 566!

DISTRIBUTION: Clanwilliam. Cape. Tulbagh. Uitenhage. Albany. Colesberg. Graff Reinet. Stutterheim. King William's Town. Komgha. Natal. Transvaal (Magaliesberg).

SESUTO: *Lehōrōmetso*. See note under *Cheilanthus hirta*.

**G. sp.**

Growing under a rock, near Matsoeberane's village, Leribe District. 4-10 in. high, sori bright yellow. April. *A. Dieterlen*, 992a!

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodoides*.

VITTARIA, Sm.

**V. lineata**, Sw.

Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Cape. Worcester. Swellendam. George. Albany. Stutterheim. King William's Town. Natal.

ACROSTICHUM, Linn.

**A. viscosum**, Sw.

Under rocks on mountain slopes. 4-11 in. high. Summer. *A. Dieterlen*, 679!; Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Cape. Worcester. Caledon. Swellendam. Albany. Stutterheim. King William's Town. Natal. Transvaal (Pilgrim's Rest).

SESUTO: *Lehōrōmetso*. *Tsebe ea'mutla*. The ear of a hare. See note under *Cheilanthus hirta*.

**A. hybridum**, Bory.

Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Knysna. King William's Town. Natal.

OSMUNDA, Linn.

**O. regalis**, Linn.

Slopes of ravine, near or under rocks on mountain slopes. 5-25 in. high, sporing in summer (December) and winter. *A. Dieterlen*, 586!, 586a!; Natal, Drakensbergen, *Buchanan*.

DISTRIBUTION: Cape. Paarl. Tulbagh. Stellenbosch. Swellendam,

George. Knysna. Uitenhage. Albany. Pondoland. Tembuland. Natal. Transvaal (Pilgrim's Rest).

SESUTO: *Lehōrōmetso*. *Lesiea*. The one who leaves (or goes away).

#### TODEA, Willd.

**T. barbara**, Moore.

Natal, Drakensbergen, *Kunze*.

DISTRIBUTION: Cape. Uitenhage. Albany. Natal.

#### MOHRIA, Sw.

**M. caffrorum**, Desv.

Shady spots and under rocks on mountain slopes. 3-18 in. high. sporing in December. *A. Dieterlen*, 475!, 841!

DISTRIBUTION: Cape. Tulbagh. Caledon. Somerset East. Stutterheim. Stockenstroom. Komgha. Transkei. Natal. Transvaal (Magaliesberg, Johannesburg).

SESUTO: *Lehōrōmetso*. See *Gleichenia polypodioides*. See also note under *Adiantum Capillus-Veneris*.

#### OPHIOGLOSSUM, Linn.

**O. vulgatum**, Linn.

Under rocks on mountain slopes. 3-9 in. high, sporing in Summer-Autumn. *A. Dieterlen*, 718!

DISTRIBUTION: Cape. Beaufort West. Uitenhage. Bedford. Somerset East. Graaff Reinet. King William's Town. Tembuland. Natal. Transvaal (Magaliesberg).

SESUTO: '*Maliyo*. The mother of food. *Tsèbè ngoe*. One ear. *Tseyananyane*. A small ear. When this plant is abundant, the natives say that there will be a good crop; they explain this by saying the plant likes moisture, and that when the plant is plentiful it is due to much rain having fallen and consequently the crops will be good. A warm decoction of the rhizomes is used as a lotion to bathe boils.

#### EQUISETACEAE.

#### EQUISETUM, Linn.

**E. ramosissimum**, Desf.

Growing in streams. 6-25 in. high, cones greyish. Summer. *A. Dieterlen*, 6!



DISTRIBUTION: Clanwilliam. Uitenhage. Somerset East. Graaff Reinet. Stutterheim. King William's Town. East Griqualand. Natal.

SESUTO: *Mohlaka-photoane*. Meaning unknown. The rhizomes are cooked and the decoction is drunk by barren women so that they may become pregnant. As a charm to drive away worms which destroy the maize, the plant is crushed and mixed with clay; in this some of the worms are imprisoned and the clay balls are then burnt in the lands. Horses feeding on the plant become fat, but after a time it leaves them lean and weak. A medicine for infants suffering with colds or colic.

## LYCOPODIACEAE.

### LYCOPODIUM, *Linn.*

*L. saururus*, Lam.

Growing on rocks and high cliffs. 2-10 in. high. Spring. *A. Dieterlen*, 719!

DISTRIBUTION: Cape. Natal.

SESUTO: *Moriri oa lilōmō*. The hair of the cliff.

*L. clavatum*, Linn.

In caves and under rocks on mountain slopes and plateau. A creeping plant 20-36 in. long. Summer. *A. Dieterlen*, 670a!, 670b!

DISTRIBUTION: Stellenbosch. Somerset East. Stockenström. King William's Town. Natal. Transvaal (Mac Mac).

SESUTO: *Moriri oa mafika*. The hair of the rocks. *Boriba bo bohōlo*. The big "Boriba" ("Boriba" is a general name for Mosses, Lichens and Liverworts) The dried plant, together with *Selaginella rupestris*, is smoked as a cure for headache.

## SELAGINELLACEAE.

### SELAGINELLA, *Spr.*

*S. rupestris*, Spreng.

Growing on or under rocks on mountain slopes. Summer. *A. Dieterlen*, 117!; Wittebergen, 5-6000 ft., *Drège*.

DISTRIBUTION: Port Elizabeth. Stutterheim. Stockenström. King William's Town. Natal. Transvaal (Houtbosch).

SESUTO: *Boriba*. Moss. See note under *Lycopodium clavatum*.

## INDEX TO GENERA.

## A

Abutilon, <i>Gaertn.</i> .....	48
Acacia, <i>Willd.</i> .....	88
Acalypha .....	259
ACANTHACEAE .....	231
Achneria .....	342
Achyranthes .....	248
Acrostichum .....	369
Acrotome .....	243
Adiantum .....	362
Aeolanthus .....	241
Agapanthus .....	299
Agrimonia, <i>Linna.</i> .....	90
Agrostis .....	345
Ajuga .....	246
Albica .....	303
Alchemilla, <i>Linna.</i> .....	89
Alepidea .....	104
Allium .....	301
Aloe .....	295
Alternanthera .....	249
AMARANTACEAE .....	247
Amaranthus .....	247
AMARYLLIDAE .....	284
Ammodorus .....	288
AMPELIDAE .....	65
Amphidoxa .....	122
Anacampseros .....	47
ANACARDIACEAE .....	65
Anchusa .....	204
Androcymbium .....	312
Andropogon .....	333
Anemone .....	33
Anisotome .....	198
Anoiganthus .....	287
Anthephora .....	341
Anthericum .....	298
Anthistiria .....	336
Antholyza .....	283
Anthospermum .....	111
Anthoxanthum .....	342
Anthriscus .....	108
Apium .....	107
APOCYNACEAE .....	188
Apodolirion .....	287
Aponogeton .....	317
ARALIACEAE .....	109
Arabis .....	37
Arctotis .....	165

Argemone .....	35
Argyrolobium .....	77
Aristea .....	278
Aristida .....	346
AROIDEAE .....	317
Artemisia .....	142
Arthrosolen .....	256
Arundinaria .....	360
Arundinella .....	341
ASCLEPIADACEAE .....	189
Asclepias .....	192
Ascolapis .....	328
Aspalathus .....	75
Asparagus .....	291
Aspidium .....	367
Asplenium .....	365
Aster .....	116
Athanasia .....	140
Athrixia .....	137
Avenastrum .....	343
Axonopus .....	339

## B

Barberia .....	233
Becium .....	240
Berkheya .....	166
Bidens .....	139
BIXINEAE .....	41
Blepharis .....	231
Boerhaavia .....	247
Bojeria .....	138
BORAGINEAE .....	203
Bouchea .....	239
Bowkeria .....	215
Brachycorythis .....	264
Brachypodium .....	360
Brachystelma .....	197
Brassica .....	39
Bromus .....	359
Brownlea .....	273
Brunsvigia .....	288
Buchenroedera .....	75
Buchnera .....	228
Buddleia .....	199
Bulbine .....	296
Bulbostylis .....	323
Buphane .....	290
Bupleurum .....	106

## C

Calamagrostis .....	386
Callitriche .....	97
Calpurnia .....	87
CAMPANULACEAE .....	174
Cannabis .....	260
CAPPARIDEAE .....	40
Carex .....	329
Carissa .....	188
CARYOPHYLLACEAE .....	44
Cassinopsis .....	62
CELASTRINEAE .....	63
Celastrus .....	63
Celtis .....	259
Cenia .....	141
Cephalanthus .....	110
Cephalaria .....	114
Cerastium .....	45
Ceropegia .....	197
Chaetacanthus .....	231
Cheilanthes .....	363
CHENOPODIACEAE .....	249
Chenopodium .....	249
Chilianthus .....	199
Chironia .....	202
Chloris .....	354
Chrysocoma .....	121
Cineraria .....	143
Cissus .....	65
Citrullus .....	100
Clematis .....	33
Cleome .....	40
Clerodendron .....	240
Cliffortia .....	90
Cluytia .....	259
Coccinia .....	101
Colpoon .....	257
Commelina .....	314
COMMELINACEAE .....	314
Cnicus .....	169
COMPOSITAE .....	115
Conium .....	106
CONVOLVULACEAE .....	205
Convolvulus .....	207
Conyza .....	129
Corchorus .....	56
Corycium .....	274
Corydalis .....	36
Cotula .....	141
Cotyledon .....	96
Crabbea .....	233
Crassula .....	91
CRASSULACEAE .....	91
Craterostigma .....	224
Crepis .....	171
Crinum .....	287
Crossotropis .....	355
Crotalaria .....	77
CRUCIFERAE .....	36
Cucumis .....	99
CUCURBITACEAE .....	99

Curculigo .....	284
Cussonia .....	109
Cyanotis .....	314
Cyathæa .....	362
Cyathula .....	248
Cyenum .....	229
Cynanchum .....	196
Cynodon .....	353
Cynoglossum .....	203
CYPERACEAE .....	318
Cyperus .....	320
Cyphia .....	117
Cyrtanthus .....	289
Cystopteris .....	362
Cytisus .....	77

## D

Danthonia .....	344
Datura .....	211
Davallia .....	362
Denckia .....	122
Deschampsia .....	361
Dianthus .....	44
Diascia .....	212
Dichilus .....	76
Dictis .....	214
Dicoma .....	170
Dierama .....	280
Digitaria .....	336
Dimorphotheca .....	162
Dioscorea .....	291
DIOSCOREACEAE .....	291
Dipadi .....	302
Diplachne .....	349
DIPSACEAE .....	114
Disa .....	270
Disperis .....	275
Dolichos .....	85
Drimia .....	302
Drosera .....	97
DROSERACEAE .....	97

## E

EBENACEAE .....	186
Echinosperrnum .....	204
Ehretia .....	203
Ehrlharta .....	355
Elephantorhiza .....	88
Eleusine .....	354
Elionurus .....	332
Eleocharis .....	323
Enneapogon .....	355
Epilobium .....	98
EQUISETACEAE .....	370
Equisetum .....	370
Eragrostis .....	349
Erianthus .....	331
Erica .....	183
ERICACEAE .....	183
Erigeron .....	118

ERIOCAULEAE .....	317	Halleria.....	215
Eriocaulon .....	317	HALORAGAEAE .....	97
Eriocephalus .....	139	Haplocarpha .....	164
Eriosema .....	86	Harpechloa .....	333
Eriospermum .....	297	Harveya .....	239
Erodium .....	62	Hebenstreitia .....	234
Erythrina .....	84	Helichrysum .....	123
Euclea .....	187	Heliophila .....	38
Eucomis .....	308	<i>Helmia</i> .....	291
Eulophia .....	261	Hermannia .....	50
Eumorphia .....	140	Herniaria .....	247
Euphorbia .....	257	Herschelia .....	270
EUPHORBIACEAE .....	257	Hertia .....	158
Euryops .....	158	Hesperantha .....	279
Exochaenium .....	202	Heteromma .....	121
		Heteromorpha .....	106
F		Hibiscus .....	49
Fadogia .....	111	Hieracium .....	171
Falkia .....	207	Hoffmanseggia .....	88
Faroa .....	202	Holothrix .....	265
Felicia .....	118	Hordeum .....	360
Festuca .....	358	Huttonaea .....	266
Ficinia .....	227	HYDROCHARIDEAE .....	261
FICOIDEAE .....	101	Hydrocotyle .....	104
Fimbristylis .....	323	Hypericum .....	47
Fingerhuthia .....	357	HYPERICINEAE .....	47
Fiurena .....	327	Hypoestes .....	234
		Hypoxis .....	284
G			
Galium.....	113	I	
Galopina .....	111	Ilex .....	63
Galtonia .....	303	ILICINEAE .....	63
Garuleum .....	116	ILLECEBRACEAE .....	247
Gazania .....	165	Imperata .....	331
Geigeria .....	138	Indigofera .....	80
GENTIANACEAE .....	199	Ipomoea .....	205
GERANIACEAE .....	57	IRIDEAE .....	276
Geranium .....	57	Ischaemum .....	331
Gerbera .....	170	Isoglossa .....	233
GESNERACEAE .....	231		
Geum .....	89	J	
Gladolus.....	280	Jasminum .....	186
Gleichenia .....	361	JUNCACEAE .....	315
Glumicalyx .....	224	Juncus .....	315
Gnaphalium .....	122	Justicia .....	233
Gnidia .....	255		
Gomphostigma .....	198	K	
GRAMINEAE .....	331	Kalanchoe .....	96
Grammanthes .....	96	Kiggelaria .....	41
Grewia .....	55	Kniphofia .....	293
Greyia .....	65	Koeleria .....	343
Gunnera .....	97	Kyllinga .....	318
Guthriea .....	99		
Gymnogramme .....	369	L	
Gymnopentzia .....	142	LABIATAE .....	240
Gymnosporia .....	63	Lactuca .....	173
		Lagarosiphon .....	261
H		Landtia .....	164
Habenaria .....	266	Lantana .....	239
Haemanthus.....	290	Lasiochloa .....	357

Lasiosiphon .....	255
Lasiospermum .....	140
Leersia .....	355
LEGUMINOSAE .....	68
LENTIBULARIEAE .....	230
Leonotis .....	246
Leontonyx .....	135
Lepidium .....	39
Lessertia .....	83
Leucosidea .....	90
Lichtensteinia .....	107
Lightfootia .....	178
Limosella .....	223
LILIACEAE .....	291
Limeum .....	104
LINACEAE .....	56
Linaria .....	214
Linum .....	56
Lipocarpa .....	327
Litanthus .....	302
Lithospermum .....	205
Littonia .....	313
Lobelia .....	174
LOGANIACEAE .....	198
Lomaria .....	365
Lotononis .....	68
Ludwigia .....	98
Luzula .....	316
Lycium .....	210
LYCOPODIACEAE .....	371
Lycopodium .....	371
Lysimachia .....	185
LYTHRARIEAE .....	97

## M

Macowania .....	136
Mahernia .....	51
Malva .....	48
MALVACEAE .....	48
Manulea .....	216
Mariscus .....	323
Massonia .....	301
Matthiola .....	36
Medicago .....	79
Melasma .....	224
Melianthus .....	65
Melica .....	356
Melolobium .....	75
Melothria .....	100
MENISPERMACEAE .....	35
Menodora .....	188
Mentha .....	241
Mesembrianthemum .....	101
Metalasia .....	136
Microchloa .....	353
Mimulus .....	222
Mohria .....	370
Monadenia .....	270
Monsonia .....	57
Moraea .....	276
Muraltia .....	43

Myosotis .....	204
Myrica .....	260
MYRICACEAE .....	260
Myrsine .....	186
MYRSINEAE .....	186
Mystacidium .....	264

## N

NAIADACEAE .....	317
Nasturtium .....	36
Nemesia .....	213
Nephrodium .....	367
Nerine .....	288
Nestlera .....	136
Nicandra .....	210
Nicotiana .....	211
Nidorella .....	119
Nolletia .....	121
Nothochlaena .....	368
NYCTAGINEAE .....	247

## O

Oenothera .....	99
OLACINEAE .....	62
Oldenlandia .....	110
Olea .....	188
OLEACEAE .....	188
Oligomeris .....	40
Olinia .....	97
ONAGRACEAE .....	98
Ophioglossum .....	370
ORCHIDEAE .....	261
Ornithogalum .....	310
Orthosiphon .....	240
Osmunda .....	369
Osteospermum .....	163
Othonna .....	162
Oxalis .....	61

## P

Pachycarpus .....	195
Panicum .....	338
Papaver .....	35
PAPAVERACEAE .....	35
Parapodium .....	189
Passerina .....	254
PASSIFLOREAE .....	99
Pelargonium .....	59
Pellaea .....	363
Pennisetum .....	340
Pentania .....	110
Pentastichis .....	343
Pentzia .....	142
Peperomia .....	253
Periglossum .....	190
Perotis .....	348
Petalactella .....	135
Peucedanum .....	108
Phalaris .....	356







## T

Talinum .....	47
Tarchonanthus .....	122
Tephrosia .....	82
Testudinaria .....	291
Tetrachne .....	357
Thalictrum .....	33
Thesium .....	256
THYMELAEACEAE .....	254
TILIACEAE .....	55
Todea .....	370
Trachypogon .....	332
Tragus .....	348
Tribulus .....	56
Tricholaena .....	341
Trifolium .....	79
Tristachya .....	342
Tritonia .....	280
Tullaghia .....	300
Tysonia .....	203

## U

UMBELLIFERAE .....	104
Urelytrum .....	332
Urginea .....	304
Ursinia .....	163
Urtica .....	260
URTICACEAE .....	259
Utricularia .....	230

## V

Vahlia .....	91
--------------	----

Valeriana .....	114
VALERIANEAE .....	114
Vellozia .....	291
Venidium .....	165
Verbena .....	239
VERBENACEAE .....	239
Vernonia .....	115
Veronica .....	224
Vigna .....	85
Vittaria .....	369

## W

Wahlenbergia .....	179
Walafrida .....	236
Watsonia .....	280
Withania .....	210
Woodsia .....	362
Wurmbea .....	312

## X

Xanthium .....	139
XYRIDEAE .....	313
Xyris .....	313
Xysmalobium .....	189

## Z

Zaluzianskya .....	220
Zea .....	360
Zinnia .....	139
ZYGOPHYLLACEAE .....	56

## INDEX TO NEW SPECIES.

A		G	
Annae (Euryops) .....	158	Galpinii (Euryops) .....	159
alba (Berkheya) .....	166	Galpinii (Wahlenbergia) .....	182
aquatica (Lobelia) .....	175		
B		H	
basutica (Hebenstreitia) .....	235	hirsuta var. Flanaganii (Vernonia) .....	116
basutica (Heliophila) .....	38	humilis (Utricularia) .....	230
basutica (Lotononis) .....	71		
basutica (Urginea) .....	306		
basutica (Wahlenbergia) .....	181		
basuticum (Melasma) .....	225		
Basutorum (Pentastichis) .....	344		
C		M	
caffrum (Anesorhiza) .....	109	macrantha (Urginea) .....	305
caffrum (Peucedanum) .....	108	macranthum (Drimia ?) .....	306
caffrum (Seseli) .....	109	macranthum (Ornithogalum ?) .....	306
capense (Hieracium) .....	171	macrophyllus (Senecio) .....	154
		montanus (Senecio) .....	155
D		P	
Dieterlenii (Cineraria) .....	143	polyodon (Crepis) .....	171
Dieterlenii (Gladiolus) .....	282	pusilla (Wurmbea) .....	313
Dieterlenii (Lightfootia) .....	178		
Dieterlenii (Lotononis) .....	72		
Dieterlenii (Scleria) .....	328		
Dieterlenii (Senecio) .....	151		
Dieterlenii (Tulbaghia) .....	300		
E		T	
espinosa (Blepharis) .....	231	triphylla (Cyphia) .....	177
		trisegmentata (Lotononis) .....	73
		trisegmentata var. robusta (Lotononis) .....	74
		Tysonii (Euryops) .....	161
		Tysonii var. Dieterlenii (Euryops) .....	162
		Tysonii (Lobelia) .....	176
F		W	
Flanaganii (Senecio) .....	152	wittebergensis var. glabrum (Galium) .....	113

## EXPLANATION OF PLATES.

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### PLATE I.

FIG. A.—1. Adult plant. 2. Calyx and ovary. 3. Corolla laid open. 4. Androecium. 5. Top of style.

FIG. B.—1. Adult plant. 2. Ray-floret. 3. Disc-floret. 4. Corolla-lobes. 5. Top of style. 6. Stamen.

### PLATE II.

FIG. A.—1. Plant (nat. size). 2. Bract. 3. Bracteole. 4. Calyx-segments. 5. Corolla. 6. Stamen. 7. Gynaecium.

FIG. B.—1. Plant (nat. size). 2. Lower lip of corolla. 3. Calyx-segments. 4. Upper lip of corolla. 5. Stamen. 6. Gynaecium.

### PLATE III.

FIG. A.—1. Plant (nat. size). 2. Calyx. 3. Vexillum. 4. Ala. 5. Carina. 6. Gynaecium.

FIG. B.—1. Portion of plant (nat. size). 2. Flower enlarged. 3. Leaf enlarged. 4. Gynaecium. 5. Stamen. 6. Transverse section of ovary.

FIG. C.—1. Plant (nat. size). 2. Flower enlarged. 3. Gynaecium. 4. Androecium.

### PLATE IV.

1. Involucre. 2. Ray-floret. 3. Disc-floret. 4. Corolla-lobes of disc-floret. 5. Style lobes. 6. Stamen. 7. Plant (reduced).

### PLATES V AND VI.

Photographs showing the sub-Alpine habit of species found in the Eastern Mountain Region.

### PLATE VII.

Map showing the Eastern Region with approximate boundaries.



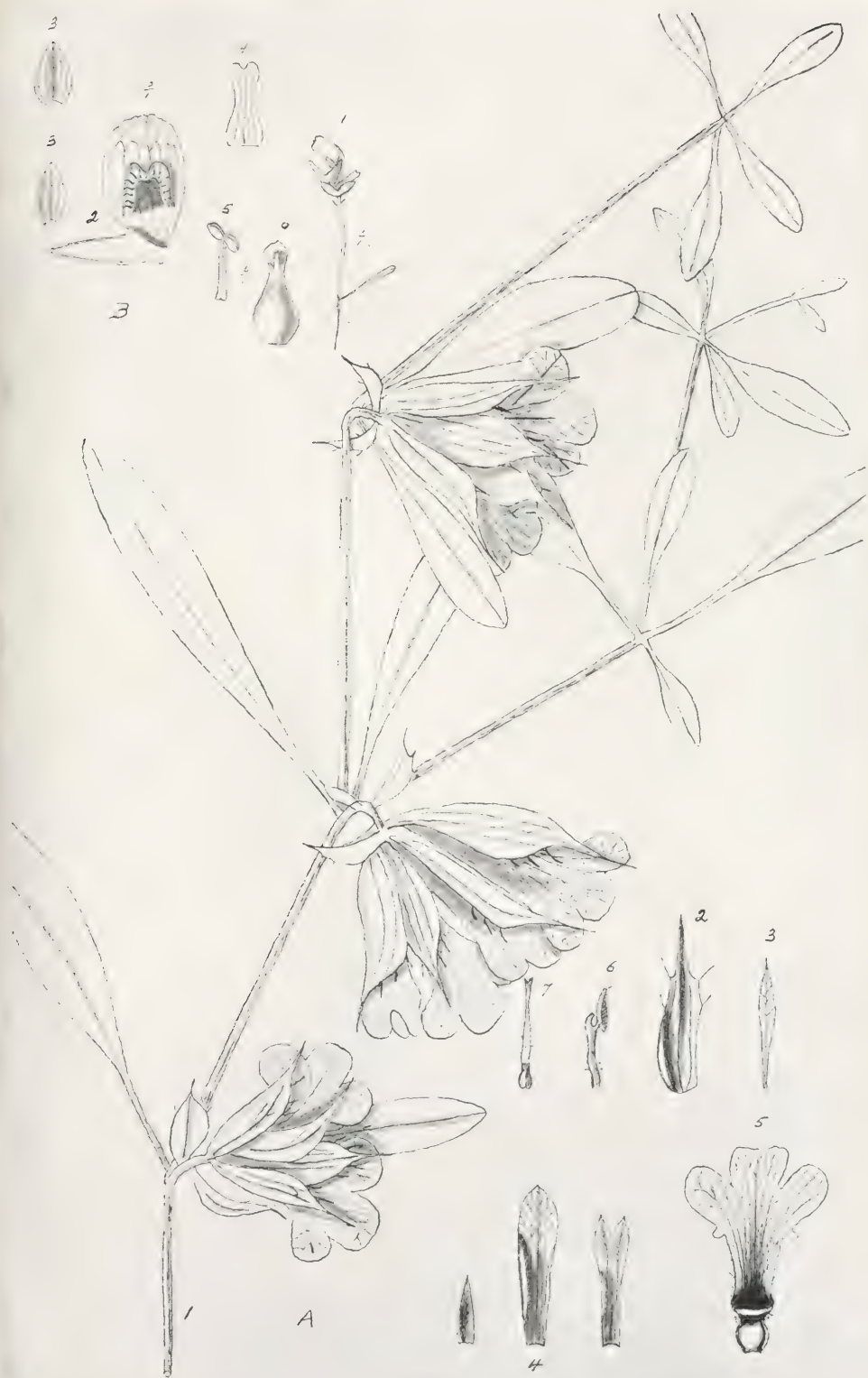


A. LOBELIA TYSONII, Phillips.

B. ANTHRIXIA FONTANA, MacOw.







A. BLEPHARIS ESPINOSA, Phillips.

B. UTRICULARIA HUMILIS, Phillips.





A. LOTONONIS TRISEGMENTATA, Phillips.

B. WAHLENBERGIA DEPRESSA, W. & E.

C. LOBELIA AQUATICA, Phillips.





*EURYOPS ANNAE*, Phillips







1.  $\times \frac{3}{4}$



2.  $\times \frac{3}{5}$



3.  $\times \frac{1}{2}$



4.  $\times \frac{2}{3}$

1. *HELIOPHILA BASUTICA*, *Phill.*      2. *PSAMMOTROPHA ANDROSACEA*, *Fenzl.*  
4. *W. DEPRESSA*, *W. & E. forma.*      3. *WAHLENBERGIA BASUTICA*, *Phill.*





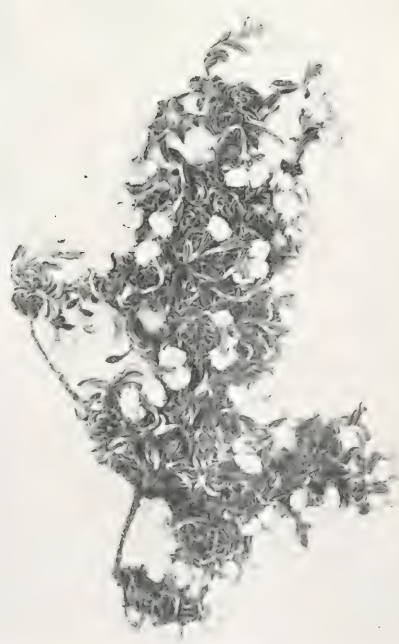
1.  $\times \frac{1}{2}$



2.  $\times \frac{1}{2}$



3.  $\times \frac{1}{3}$



4.  $\times \frac{1}{3}$

1. *HELICHRYSUM CALOCEPHALUM*, Schltr.

2. *H. RADNII*, Sp. Moore.

3. *CREPIS POLYODON*, Phill.

4. *H. CHIONOSPHERUM*, D.C.











2.—*Contributions to a Knowledge of the Flora of South-West Africa.*

1. *List of Grasses.*—By Miss S. GARABEDIAN, B.A.,  
Botanical Assistant.

(With Plate VIII.)

[UNDER the above title it is proposed to issue the results of the Botanical Survey of South-West Africa undertaken by the South African Museum in conjunction with the Administration of South-West Africa. The papers will be published from time to time as the material is worked up.

As in the case of the collateral series of Reports on the Fauna, the country has been divided into regions for comparative purposes. Although the limits of these regions are somewhat arbitrary and vague, yet they follow in a general way the topography. Five regions are adopted: (*Great*) *Namaqualand*, from the Orange River to about latitude  $23^{\circ}$  S.; *Damaraland*, from about  $23^{\circ}$  S. to a line running roughly from Franzfontein to Namutoni on the Etosha Pan; *Ovamboland*, the sandy flat country stretching from the Etosha Pan to the Portuguese border and from the Okavango River on the east to the mountainous country on the west called the *Kaokoveld*, which lies between Franzfontein and the Cunene River; *Namib*, the sand-dune belt which stretches along the coast between the mouths of the Orange and Cunene Rivers. See map at end of paper.—EDITOR.]

The following list of grasses has been compiled from various collections, and with a few exceptions the specimens quoted have been seen by the compiler, and representatives of all but a small minority are in the Herbarium of the South African Museum.

The part traversed has been divided up roughly into the following geographical regions: (*Great*) *Namaqualand*, *Damaraland*, and *Ovamboland*, thus including the Orange River, about  $29^{\circ}$  lat., to the Cunene River,  $17^{\circ}$  lat., and extending to about  $20^{\circ}$  long. E. Neither the region known as the *Namib* along the coast line nor the *Kaokoveld* are included. It is intended to issue a supplementary list of the grasses of these regions later.

Of the collectors whose names appear frequently in this paper, the late Dr. H. H. W. Pearson, of the S.A. College, in the Percy Sladen

Memorial Expeditions of 1908–1911 and 1912–1913, collected in Great Namaqualand, particularly in and round the Great and Little Karas Mountains. Dr. Paul Range in 1906–1913 collected round Angra Pequenas (Lüderitzbucht), Warmbad, Keetmanshoop, and Gibeon. Miss Bleek and Mr. S. Gillman in a South African Museum Expedition, 1921–1922, collected in Damaraland round Sandfontein, Grootfontein, and Gobabis; as also did Miss Wilman, of the M'Gregor Museum, Kimberley. In the South African Museum Expeditions of 1921 and 1923, Mr. K. H. Barnard collected farther north in Ovamboland, round the Etosha Pan and as far as the Cunene River. Dr. Hans Schinz and Dr. K. Dinter have collected in all the regions.

Throughout this paper, F.C.=Flora Capensis, and F.T.A.=Flora of Tropical Africa; and when reference is made to these works it is to Volume VII of the former and to Volume IX of the latter; the page is given in each instance, but the volume number is not quoted.

The genera are arranged according to the key given by Dr. O. Stapf in the Flora of Tropical Africa—the species within the genera are arranged alphabetically.

Thanks are due to Dr. O. Stapf, of the Kew Herbarium, without whose valuable assistance this list would not have been complete; and also to Miss D. K. Hughes, at one time Temporary Assistant at Kew.

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ANDROPOGONEAE.

i. VOSSIA, F.T.A. 8.

1. **V. cuspidata**, *Griff.* F.T.A. 41.

Ovamboland : Cunene banks, in water, *Barnard*, 1.

One of the principal constituents of the "sudd" of the Nile and its tributaries, and other rivers of tropical Africa.

GENERAL DISTRIBUTION : Northern Nigeria, Uganda, Lower Guinea, Belgian Congo, Nyasaland, Port. E. Africa.

ii. HEMARTHRIA, F.T.A. 9.

1. **H. fasciculata**, *Kunth.* F.C. 329 ; F.T.A. 55 (*Rotiboellia compressa*, Linn., f. Suppl., 114 ; var. *fasciculata*, Hack., *Androp.* in D.C. Monogr. Phan. vi, 286).

South-West Africa (*Range*) !

GENERAL DISTRIBUTION : Throughout the warm countries of both hemispheres, in many localities evidently introduced.

iii. ELYONURUS, F.C. 332 ; F.T.A. 9.

1. **E. argenteus**, *Nees.* F.C. 332 ; F.T.A. 70.

Damaraland : near Windhoek, Gaub (*Dinter*) ; Okanokasewa, *Dinter*, 639 ! (F.T.A. 71). Otjitjika, *Dinter*, 2863 ; Zwartwater, *Dinter*, 2875. A very sour grass, disliked by all kinds of stock, having a bitter turpentine flavour (*Kew Bull.* 1911, 158).

GENERAL DISTRIBUTION : French Congo, Belgian Congo, Nyasaland, Rhodesia.

iv. IMPERATA, F.C. 320 ; F.T.A. 87.

1. **I. cylindrica**, *Beauv.* F.C. 320 ; F.T.A. 87 (*I. arundinacea*, Cyr. Pl. Rar. Neap., fasc. ii, 26, t. 11).

Damaraland : Okosongominja, *Dinter*, 1767 !

The "alang alang" of the Malays, often covers enormous areas, and when entering cultivated land may become a serious pest.

GENERAL DISTRIBUTION : In the warm regions of both hemispheres.

v. EULALIA, F.T.A. 10.

1. **E. geniculata**, *Stapf.* F.T.A. 101.

Ovamboland : Cunene banks, *Barnard*, 3 !

GENERAL DISTRIBUTION : Belgian Congo, Rhodesia.

## vi. SORGHUM, F.T.A. 104.

1. **S. bicolor**, Moench, var. *odoratum*, Stapf. F.T.A., 127 (*Andropogon sorghum*, subsp. *sativus*, var. *odoratus*, Hack.).

Ovamboland : Ondonga ; Olukonda, Schinz, 22 ! 650 !

2. **S. caffrorum**, Beauv. F.T.A. 130.

Ovamboland : Ondonga ; Olukonda, Schinz !

*Andropogon sorghum*, vars. *albidus*, *usorum*, *rubicolor*, *Ondongae*, Koern., are referable to the above.

GENERAL DISTRIBUTION : Cultivated in South Africa in several races, also in Mauritius, and, under the name of Kafir, in North America.

3. **S. versicolor**, J. N. Andersson. F.T.A. 138 (*Andropogon serratus*, var. *versicolor*, Hack.).

Damaraland : Tsumeb, in quartz gravel, Dinter, 2500.

GENERAL DISTRIBUTION : Nileland, Rhodesia, Mozambique District, also in the Transvaal (Rustenburg, near the Crocodile River, Burt-Davy, 9305 !).

## vii. VETIVERIA, F.T.A. 10.

1. **V. nigritana**, Stapf. F.T.A. 157.

Ovamboland : Cunene banks, Barnard, 4 !

GENERAL DISTRIBUTION : Upper Guinea, Gold Coast, Lower Guinea, Angola, Rhodesia.

## viii. AMPHILOPHIS, F.C. 345 ; F.T.A. 11.

1. **A. pertusa**, Stapf. F.C. 345 ; F.T.A. 175 (*Andropogon pertusus*, Willd. Sp., pl. iv, 922).

Ovamboland : Cunene banks, Barnard, 5 !

GENERAL DISTRIBUTION : Cape Verde Islands, Abyssinia, Zanzibar, German East Africa. In Arabia, and in India from Afghanistan to Ceylon and Behar. Introduced in Mauritius and Jamaica.

A valuable fodder in India for grazing as well as for stacking ; very common and characteristic in cattle compounds.

2. **A. radicans**, Stapf. F.C. 344 ; F.T.A. 173 (*Andropogon radicans*, Lehm.).

Namaqualand : Eastern Karasberg, sandstone plateau upper Keiap, Pearson, 8501 ! ; sandstone on upper slopes Narudas Süd, Pearson, 8179 ! Hereroland : without precise locality, Lüderitz, 69, 74.

GENERAL DISTRIBUTION : British Somaliland, Brit. E. Africa, Cape Colony.

ix. DICHANTHIUM, F.C. 335; F.T.A. 11.

1. **D. annulatum**, *Stapf*. F.C. 350; F.T.A. 178 (*Andropogon annulatus*, Forsk, Fl. Aegypt. Arab., 173).

Namaqualand: Kuibis River, *Range*, 369; Ganaams, among rocks in Leber River, *Pearson*, 9370; Awas Mts., in pass between Haris and Aub, *Pearson*, 9601. In Aristida-steppe near Quartel (*Dinter*); near Leber River (*Dinter*).

GENERAL DISTRIBUTION: From Morocco through N. Africa, the Orient, and India to China and Australia. Considered good fodder in India.

2. **D. papillosum**, *Stapf*. F.T.A. 179 (*Andropogon papillosus*, Hochst. ex A. Rich. Tent. Fl. Abyss. ii, 457).

Namaqualand: Kuibis River (*Range*)! Damaraland: Gobabis, *Dinter*, 2777! flowering in February. Otavifontein, *Heering* and *Grimme*; Otjikvaro-Okaharui, *Dinter*, 3286! Used as fodder.

GENERAL DISTRIBUTION: French Guinea, Cameroons, Sudan, Belgian Congo, Angola, Zanzibar. Also in tropical America from Mexico to Brazil.

x. EREMOPOGON, F.T.A. 11.

1. **E. foveolatus**, *Stapf*. F.T.A. 183 (*Andropogon foveolatus*, Del. Fl. Égypte, 16, t. 8, fig. 2).

Damaraland: Omaheke of Otjitjikabergkette (*Dinter*).

GENERAL DISTRIBUTION: Cape Verde Islands, Nubia; also in the Canaries, and from Egypt and tropical Arabia to India, where it is considered good fodder.

xi. SCHIZACHYRIUM, F.C. 334; F.T.A. 11.

1. **S. Engleri**, *Pilg.* in Engl. Jahrb. liv, 281 (1917).

Damaraland: Otjitjika, 35 km. from Grootfontein in Omahake formation, 1500 m., *Engler*, 6314A (*Dinter*).

2. **S. Jeffreysii**, *Stapf*. F.T.A. 198 (*Andropogon Jeffreysii*, Hack. in Proc. Rhod. Scient. Assoc. vii, ii (1908), 70).

Ovamboland: Cunene; Namakunde, *Barnard*, 2!

GENERAL DISTRIBUTION: Rhodesia: Matopo Hills and Bulawayo.

3. **S. tenuispicatum**, *Pilg.* in Engl. Jahrb. liv, 282 (1917).

Damaraland: Grootfontein, *Dinter*, 2840.



## xii. ANDROPOGON, F.C. 313; F.T.A. 11.

1. **A. Schinzii**, Hack. F.C. 341; F.T.A. 245.

Ovamboland: Oshando, very common, *Schinz*, 670. Damaraland: Enguruwau, grass-steppe, *Dinter*, 3307!; Waldau, *Dinter*, 437.

GENERAL DISTRIBUTION: Abyssinia, Belgian Congo, Rhodesia, Griqualand, and Transvaal (Johannesburg).

2. **A. eucomus**, Nees, Fl. Afr. Austr. 104. F.T.A. 230.

Damaraland: Otavifontein, *Dinter*, 907; Okosongominja, *Dinter*, 1786.

GENERAL DISTRIBUTION: Africa south of the Equator, and Madagascar.

3. **A. gayanus**, Kunth. F.T.A. 261; var. *bisquamulatus*, Hack.

Ovamboland: Cunene banks; Amtenya-Katiti, *Barnard*, 6! Damaraland: *Nels*, 76.

GENERAL DISTRIBUTION: all tropical Africa.

## xiii. CYMBOPOGON.

1. **C. excavatus**, Stapf. F.T.A. 285 (*Andropogon schoenanthus*, var. *versicolor*, Hack., F.C. 354).

Ovamboland: between Cunene River (Otjimbombe) and Eunda, *Barnard*, 7! Damaraland: near Gibeon, sandbank, flowering May, *Range*, 1357!; near Klein Witvlei between Gobabis and Windhuk, *Gillman*, 16,447! 16,446!; dunes east of Gobabis (*Wilman*). Hereroland: *Fleck*, 77. Namaqualand: Reheboth, *Fleck*, 920.

GENERAL DISTRIBUTION: South Africa, extending southwards to Griqualand (west and east) and the mountains of Natal.

2. **C. marginatus**, Stapf. K.B. xi, 158; F.T.A. 280 (*Andropogon Nardus*, var. *marginatus*, F.C. 352).

Damaraland: Kamms, flowering April, *Range*, 295! Hereroland: *Lüderitz*, 33.

GENERAL DISTRIBUTION: Cape Colony and Natal. No use for fodder.

3. **C. plurinodis**, Stapf ex Burt-Davy. F.C. 353; F.T.A. 273 (*Andropogon plurinodis*, Stapf in Dyer, F.C.).

Damaraland: Kamms River side, 1450 m., flowering January, *Range*, 904! Namaqualand: Schakalskuppe hilltops, *Pearson*, 4252!; Akam River bed, *Pearson*, 4764!; Central Karasberg, near water



at Krai Kluff, *Pearson*, 8503! Hereroland: between Haris and Kurumanas, *Fleck*, 557.

GENERAL DISTRIBUTION: All over South Africa, with the exception of the south-west and the littoral in the east.

4. **C. suaveolens**, *Pilg.* in Engl. Jahrb. liv, 285 (1917).

Damaraland: Klein Packreim, *v. Trotha*, 42; Waterburg, *Dinter*, 1825.

Probably identical with **C. excavatus**, descr. compared.

xiv. HYPARRHENIA, F.T.A. 11.

1. **H. rufa**, *Stapf.* F.T.A. 304.

Ovamboland: Omurambas, near Namakunde, *Barnard*, 8!

Commonly used for grass fencing in Nigeria, and for thatching in Angola.

GENERAL DISTRIBUTION: French Guinea, Abyssinia, Belgian Congo, Zanzibar, Rhodesia; also in Mascarene Isles and in Brazil.

xv. TRACHYPOGON, F.C. 331; F.T.A. 12.

1. **T. plumosus**, *Nees.* F.T.A. 403.

Ovamboland: Namakunde, *Barnard*, 78!

GENERAL DISTRIBUTION: In South Africa, Madagascar, and the hot parts of America from Texas and Arizona to the Argentine.

xvi. HETEROPOGON, F.C. 335; F.T.A. 12.

1. **H. contortus**, *R. and S.* F.T.A. 411.

Ovamboland: Cunene banks; Onambeke, moist ground, *Barnard*, 9!; Ukualonkathi, *Barnard*, 10! Damaraland: Tsumeb, in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*); Otavifontein (*Heering and Grimme*); Omusema near Okahandja, Nov., *Dinter*, 3329! In pure stands of 50 hectares at Eahero Farm (*Dinter*).

The occurrence of extensive "sour grass," mostly *H. contortus*, in the Omaheke of Okahandja is very striking. This grass is very much appreciated by cattle as long as the culms are young; it becomes a nuisance when mature.

GENERAL DISTRIBUTION: Common in the tropics, also in the Mediterranean region.

2. **H. melanocarpus**, *Benth.* F.T.A. 413.

Ovamboland: Cunene banks, *Barnard*, 11!; Oshando, *Schinz*, 653.

GENERAL DISTRIBUTION. Widely spread throughout the hot countries of both hemispheres, probably of American origin.

## xvii. THEMEDA, F.C. 367; F.T.A. 12.

1. *T. triandra*, Forsk. F.C. 367; F.T.A. 416.Var. *Burchelli*.

Ovamboland: Cunene banks, *Barnard*, 12! Namaqualand: Eastern Karasberg, sandstone on summit Narudas Süd, *Pearson*, 8224!

One of the commonest grasses of the drier regions of Africa, forming extensive associations. It is the "Rooi" grass of S. Africa and, like its Australian representatives, *Themeda australis*, Stapf (*Anthistiria australis*, R. Br.), is a most valuable fodder grass (see Trans. Agric. Journ. iii, 287).

## PANICEAE.

## i. DIGITARIA, F.C. 313; F.T.A. 13.

1. *D. eriantha*, Steud. F.C. 375; F.T.A. 429.

Ovamboland: Ondonga to Namakunde, *Barnard*, 14!; Bushveld, Omusere to Ondonga, *Barnard*, 16487, in S.A.M.H.; Cunene banks, *Barnard*, 15!; Onambeke, grass steppes, *Barnard*, 16! Namaqualand: Khubgarub, 1500 m., *Range*, 240!; Schakalskuppe, 1000 m., *Range*, 92!; A. 38!; Kuibis quartz rocks, 1400 m., *Range*, 651!; Kuibis quartzite, 1330 m., *Range*, 853!; Kamms River side, 1450 m., *Range*, 901b! Central Karasberg: Krai Kluft, *Pearson*, 8516!; sand near base of kopje, 15 miles south-east of Grundoorn, *Pearson*, 4556!; rock crevices in kopje between Dabaigabis and Grundoorn, *Pearson*, 3168!; stony bed of Akam River, *Pearson*, 4763!

Common throughout the eastern half of South Africa, rare in the west. A useful fodder for cattle.

2. *D. marginata*, Link. F.T.A. 439.

Namaqualand: Kuibis, in cultivated land, 1300 m., *Range*, 964!

GENERAL DISTRIBUTION: Throughout the warmer parts of the New and the Old World, but apparently very rare in tropical Africa.

## ii. ERIOCHLOA, F.T.A. 14.

1. *E. acrotricha*, Hack. F.T.A. 499.

Damaraland: Okahandja (*Dinter*); Nagels Farm, *Dinter*, 3395!

GENERAL DISTRIBUTION: Upper Guinea, Lower Guinea, Nile Land, Mozambique District; also in tropical Arabia and occasionally in India.

iii. LEUCOPHRYS, F.T.A. 14.

1. **L. mesocoma**, Rendle. F.T.A. 503 (*Panicum mesocomum*, Stapf in Dyer, F.C. 387).

Namaqualand: Dry river bed 20 km. north of Raman's Drift, 2400 ft., *Pearson*, 4544!; sandy valley 20 km. north of Raman's Drift, 3200 ft., *Pearson*, 4515; sandy river bed at Buchholzbrunn, 3250 ft., *Pearson*, 3679; clumps in river bed 25 km. north of Warmbad, *Pearson*, 4302. Great Karasberg: *Pearson*, 3519. Little Karas Mts., western foothills near Holoog, on sandy banks of stream, *Pearson*, 9740; sandy places in pans between Groot Rozybosch and Wortel, *Pearson*, 3598; on Leber River in white sand at Keetmanshoop (*Dinter*).

GENERAL DISTRIBUTION: South Africa (Zeyher in Herb. Hook.; Drège in Herb. Benth.), Angola.

2. **L. glomerata**, Stapf. F.T.A. 504 (*Panicum glomeratum*, Stapf in Dyer, F.C. 393).

Damaraland: Welwitsch, *Galpin* and *Pearson*, 7427!; North of Salem on granite, *Gürich*, 130!; Namaqualand: Garub, granite rocks, *Range*, 515!; Bethany District, in sandy places, *Range*, 1004!; near Gibeon Dunes near Elephant river, 1200m., *Range*, 1438!; sand dunes at Sandverhaar, *Pearson*, 4657!; sandy river bed at Buchholzbrunn, *Pearson*, 3668!; *Schinz*, 640!; on dunes at Sandverhaar and near Wittvlei (*Dinter*). Hereroland: sandy banks of River Suachaub near Hykamchab, 200 m., April, *Marloth*, 1186! *Lüderitz*, 37.

GENERAL DISTRIBUTION: Angola.

iv. BRACHIARIA, F.C. 383; F.T.A. 14.

1. **B. eruciformis**, *Gris*. (*B. Isachne*, Stapf in F.T.A. 552; *Panicum Isachne*, Roth ex Roem and Schult, F.C. 390).

Damaraland: Okahandja River between Okahandja and Osona (*Dinter*).

GENERAL DISTRIBUTION: Nile Land, Mozambique District, and Zanzibar.

2. **B. nigropedata**, Stapf. F.T.A. 535 (*Panicum nigropedatum*, Munro).

Damaraland: Otavifontein (*Heering*), between Gobabis and Gaikus (*Gillman*)!; between Gobabis and Sandfontein (*Gillman*)! 16426; dunes east of Gobabis (*Wilman*) in S.A.M.H.!; between

Grootfontein and Lane, *Lightfoot*, 12733 !; between Tsumeb and Bobos (*Dinter*); Otjisondu (*Dinter*).

GENERAL DISTRIBUTION: Brit. East Africa, Rhodesia, Port. East Africa.

3. **B. ramosa**, *Stapf*. F.T.A. 543.

Damaraland: Tsumeb, in quartz gravel on Okongawa Mt. near Ovikokorero (*Dinter*).

GENERAL DISTRIBUTION: India and Cape Verde Islands. This is more likely to be the following species.

4. **B. Rautanenii**, *Stapf*. F.T.A. 513 (*Panicum Rautanenii*, Hack.).

Ovamboland: Cunene banks, in water, *Barnard*, 17 !; Olukonda, Rautanen (type) *B. Rautaneni*, see F.T.A. 513.

5. **B. regularis**, *Stapf*. F.T.A. 544.

Ovamboland: Omaseru to Ondonga, bushveld, *Barnard*, 16486 !

GENERAL DISTRIBUTION: French Sudan, Nubia, Angola, Zanzibar, N.E. Transvaal, and Madagascar.

6. **B. xantholeuca**, *Stapf*. F.T.A. 541.

Ovamboland: Omaseru to Ondonga, bushveld, *Barnard*, 16460 !; Olukonda, *Schinz*, 139; Onjodjahere, *Schinz*, 474.

GENERAL DISTRIBUTION: Northern tropical Africa.

v. PASPALUM, F.C. 313; F.T.A. 14.

1. **P. serobiculatum**, *Linn*, var. *Commersonii*, *Stapf*. F.T.A. 573.

Ovamboland: Cunene banks, *Barnard*, 20 !

An erect growing annual generally regarded as food by the natives of India, but it is by no means a wholesome article of diet, and suspicious cases of cattle poisoning have been connected with this grass.

GENERAL DISTRIBUTION: Widely dispersed through the tropics of the Eastern Hemisphere.

vi. UROCHLOA, F.C. 418; F.T.A. 15.

1. **U. trichopus**, *Stapf*. F.T.A. 589.

Ovamboland: Mafa, *Barnard*, 16508 ! Damaraland: Namutoni, *Barnard*, 16485 !; Otjivero, between Gobabis and Windhoek, *Gillman*, 16449 !

GENERAL DISTRIBUTION: French Sudan, Kordofan, Southern Abyssinia.

2. **U. pullulans**, *Stapf*. F.T.A. 590.

Damaraland : Namutoni, *Barnard*, 16518 !

GENERAL DISTRIBUTION : Port. E. Africa, Nyasaland.

3. **U. brachyura**, *Stapf*. F.T.A. 592.

Ovamboland : Onolongo, *Barnard*, 21 ! ; Olukonda, *Schinz*, 638.

4. **U. bulbodes**, *Stapf*. F.T.A. 593.

Ovamboland : Mafa, *Barnard*, 20 !

Excellent fodder for cattle, according to Welwitsch.

GENERAL DISTRIBUTION : Abyssinia, Angola, Belgian Congo, N. and S. Rhodesia.

vii. ECHINOCHLOA, F.T.A. 15.

1. **E. Holubii**, *Stapf*. F.T.A. 606 (*Panicum Holubii*, *Stapf* in F.C. 394).

Damaraland : Okahandja, *Dinter*, 2769 !

GENERAL DISTRIBUTION : King William's Town, Transvaal, Upper Zambesi.

2. **E. pyramidalis**, *Hitch and Chase*. F.T.A. 615.

Ovamboland : Mafa, *Barnard*, 16483 ! ; Cunene banks, *Barnard*, 23 ! Damaraland : in pools near Otavifontein (*Dinter*) ; Otjihangwe (*Dinter*).

GENERAL DISTRIBUTION : Upper and Lower Guinea, Nyasaland, Rhodesia.

*E. pyramidalis*, together with *E. stagnina*, are the chief constituents of the great water meadows of the inundation region of the Niger and of Lake Chad, and also enter largely into the "sudd" of the Nile and other African rivers. According to Chevalier the grains are used as food in Bornu (vulg. *Kreb* or *Kasha*), and in Senegambia, the French Sudan (vulg. *Linguii*). Barter states that in Nupe "an impure salt or carbonate of soda is made by burning this grass, used for culinary purposes when salt is not to be procured," and Lécarré describes it as an excellent fodder grass, much relished by animals. See F.T.A. 615.

3. **E. stagnina**, *Beauv.* F.T.A. 617.

Ovamboland : Cunene banks, in water, *Barnard*, 24 ! ; Ukulonkathi, *Barnard*, 25 !

GENERAL DISTRIBUTION : Upper and Lower Guinea, Nile Land, Rhodesia, Portuguese East Africa. See above.



## viii. PANICUM, F.C. 313; F.T.A. 15.

1. **P. coloratum**, *Linn.* F.C. 409; F.T.A. 713.

Ovamboland: Cunene banks, *Barnard*, 26!; Onolongo and Onambeke grass-steppes, *Barnard*, 27! 28! Damaraland: Sandfontein, *Wilman*!; Namutoni to Otjikito, *Barnard*, 16497!

GENERAL DISTRIBUTION.: Upper Guinea, Mozambique District, Nile Land.

2. **P. maximum**, *Jacq.* F.C. 404; F.T.A. 655.

Ovamboland: Mafa, *Barnard*, 30! Namaqualand: Central and Eastern Karasberg, ravines at base of Scharfenstein, and at Narudas Süd, *Pearson*, 8517!

Very rich in nutritive qualities, and has the reputation of being one of the best fodder grasses of the tropics, where it is commonly cultivated.

GENERAL DISTRIBUTION: Throughout N. and S. Africa, Madagascar, the Mascarenes, and in Yemen. Introduced and widely spread in India and America.

3. **P. minus**, *Stapf*, var. *plantifolium*, *Stapf.* F.C. 410.

Damaraland: Sandfontein, *Bleek*, 16475! Namaqualand: Kuibis on quartzite, 1350 m., flowering Feb., *Range*, 859! 1645!; Kunab, on back sand, April, *Range*, 1014!; Central and Eastern Karasberg, granite in ravine base of Scharfenstein, *Pearson*, 8520!; granite, lower slopes Narudas Süd, *Pearson*, 8521!; Warmbad, *Pearson*, 4031!; Omusema, on granite, *Dinter*, 3344!

One of the most valuable forage grasses for moist land of laagtes, yielding a heavy crop of good forage hay.

Common on old lands, and one of the two grasses sold (in Transvaal) for sweet grass hay.

4. **P. numidianum**, *Lam. Encycl.* i (1791), 172. *Dur. et Schinz*, *Consp.* v, 757.

Namaqualand: Homeib, *Schinz*, 637. Hereroland: *Lüderitz*, 70.

GENERAL DISTRIBUTION: Cape Colony and North Africa, introduced from Brazil.

5. **P. Pearsoni**, *Bol. f.* *Ann. Bol. Herb.* i, 107 (1905).

Great Namaqualand: Central Karasberg, sandstone plateau on summit of Long Hill, east of Krai Kluft, *Pearson*, 8518!

6. **P. repens**, *Linn.* F.C. 409; F.T.A. 708.

Damaraland: Otavifontein (*Heering*); Swakop River mouth, *Galpin*



and *Pearson*, 7409 ! Considered a very good fodder and also useful as a sand binder.

GENERAL DISTRIBUTION : Widely distributed on the tropical and subtropical coasts of both hemispheres and in India and Africa, also in and along rivers ; probably originally a native of the Old World.

7. **P. Schinzii**, *Hack.* F.T.A. 715.

Ovamboland : Amtenya-Katiti, *Barnard*, 29 ! ; Olukonda, Ondonga, *Schinz*, 641.

*Insufficiently known species—*

1. **Panicum chromatostigma**, *Pilg.* n. sp. in *Engl. Jarhb.* 33 (1902).

Damaraland : Otjimbingue, *I. Fischer*, 75 (1897).

2. **P. melanospermum**, *Mez*, n. sp. in *Engl. Jahrb.* 57, 185. Hereroland : *Witzenhaus* in *Herb. Hamburg.*

3. **P. crassipes**, *Mez*, *loc. cit.* *Grossarth*, 4 ; *Seiner*, 126 (typus).

4. **P. kalaharensis**, *Mez*, *loc. cit.* *Schultze*, 318, 342p, 356c.

5. **P. arbusculum**, *Mez*, *loc. cit.* Coll. ignot. *Herb. Hamburg.*

6. **P. radula**, *Mez*, *loc. cit.* *Morgenstern* (typus), S.W.A.

viii. **Setaria**, F.C. 419 ; F.T.A. 16.

1. **S. appendiculata**, *Stapf.* F.C. 420.

Great Namaqualand : Western, Central, and Eastern Karasberg, among granite blocks on high plateau east of Wasserfall, *Pearson*, 8511 ! ; sandy slopes S.W. of Krai Kluft, *Pearson*, 8512 ! ; lower foothills, Narudas Süd, *Pearson*, 8172 ! ; sandy plains in granite torrent bed, Narudas Süd, *Pearson*, 8326 ! ; Garius, *Dinter*, 4244 ! Damaraland : Onguati, chalk bush-steppe, *Dinter*, 2831 ! ; near River Onanis, *Belck*, 63c.

2. **S. aurea**, *A. Br.* F.C. 426.

Ovamboland : Cunene banks, *Barnard*, 32 ! Damaraland, in pools near Otavifontein (*Dinter*).

Distributed in slightly different forms throughout tropical Africa and Asia.

3. **S. glauca** (L.), *P. Beauv.* *Essai Agrost.*, 1812, p. 51.

Namaqualand : Gamochab, *Schinz*, 607.

GENERAL DISTRIBUTION : Widely spread in Africa ; cosmopolitan.

4. **S. sagittifolia**, *Walp.* *Ann.* iii, 721.

Ovamboland : Cunene banks, shady places under trees, *Barnard*,

31! Olukonda, *Rautanen*, 84. Damaraland: Gaub (*Dinter*); on red loam and sand at Tsumeb (*Dinter*), 84.

GENERAL DISTRIBUTION: Abyssinia.

5. *S. verticillata*, *Beauv.* F.C. 429.

Damaraland: In bed of stream at Windhuk, *Gillman*, 16451!; Orab (*Heering*), Namutoni, *Barnard*, 16507!; Okahandja, *Dinter*, 1626! Namaqualand: Soromas Vlei, 1000 m., flowering April, *Range*, 665; Kuibis on cultivated ground, *Range*, 660! Ovamboland: N. of Ondonga (Ovakuayama), *Rautanen*, 1 (1906).

A useless annual naturalised weed—tangles wool of sheep and goats.

GENERAL DISTRIBUTION: Throughout Africa and India to Malaya. Elsewhere (Europe, Australia, America) only as a weed.

6. *S. viridis*, *Beauv.* Agrost. 51.

(*ambigua*, Guss.)

Damaraland: Hereroland, *Hoffner*, 114c.

ix. TRICHOLAENA, F.C. 441; F.T.A. 16.

1. *T. brevipila*, *Hack.* F.C. 445.

Namaqualand: Gamoxab, *Schinz*, 631.

2. *T. monachyron*, *Oliv.* in Hook. Icon. pl. xxv (1895), t. 2374.

Ovamboland: Cunene banks, Great Falls, and other localities, growing 1 to 2 ft. high, flowering March, *Barnard*, 78!

3. *T. rosea*, *Nees.* F.C. 443.

Ovamboland: grass veld round Andoni, *Barnard*, 16490!; Kachipu, near Cunene banks, *Barnard*, 35!; Onolongo, grass-steppe, *Barnard*, 33!; Cunene banks, *Barnard*, 36! Namaqualand: Eastern Karasberg, sandstone cliffs, Narudas Süd, *Pearson*, 8513! Damaraland: between Gobabis and Sandfontein, *Gillman*, 16441!; Sandfontein, *Bleek*, 16478!; Gaub (*Dinter*); Kamelbaumbusch, on stiff loam near Ovikokorero; forming pasture to the exclusion almost of anything else in thorn bush of Swakop (*Dinter*); Okakueyo, *Dinter*, 3331! Found plentifully on roadsides and old lands; it makes good hay.

GENERAL DISTRIBUTION: South and tropical Africa, Madagascar and South Arabia.

4. *T. setifolia*, *Stapf.* F.C. 442.

Ovamboland: Namakunde, *Barnard*, 34! Damaraland: Awas Mts., 12 km. E. of Windhuk, on quartzite slopes, *Pearson*, 9798! Namaqualand: N. of Choaberib, in dry stream bed, *Pearson*, 9412!

GENERAL DISTRIBUTION: Cape, Transvaal, Griqualand West, Natal.

5. **T. sphacelata**, *Benth.* in Hook. Nig. Fl. (1849), p. 559.

Ovamboland : Olukonda, *Rautanen*, 138.

GENERAL DISTRIBUTION : Tropical West Africa.

x. XYOCHLAENA, *Stapf* in Hook. f. Ic. Plant. t. 3098.

1. **X. arenaria**, *Stapf*, *loc. cit.*, sub. t. 3098 (*Tricholaena arenaria*, *Nees*, var. *glauca*, *Stapf* in *Dyer*, F.C. 446).

Namaqualand : Kamms, *Range*, A. 39, 91, 297 ! ; Eastern Karas-berg, among stones in lower foothills, *Narudas Süd*, *Pearson*, 8167 ! ; *Tiras*, *Schinz*, 673 ; sandy plains in valleys between Ausis and Kuias, *Schenck*, 80.

GENERAL DISTRIBUTION : America.

2. **X. capensis**, *Stapf*, *loc. cit.*

Namaqualand : Gabis, *Pearson*, 4952 ; dry stream bed between Dabaigabis and Grunddoorn, *Pearson*, 3119 ; Garius, *Dinter*, 4246 !

3. **X. monachne**, *Stapf*, *loc. cit.* (*Panicum Madagascariense*, *Spreng.* Syst. veget. i (1825), 317).

Damaraland : between Nauchas and Areb on plains of granitic sand, *Pearson*, 9022 ! Hereroland : *Lüderitz*, 39 ; Otjimbingue, *I. Fischer*, 60. Hereroland : *Fleck*, 123.

Var. **minus**, *Hack.*

Damaraland : *Marloth*, 1378.

GENERAL DISTRIBUTION : Cape Colony, Angola, E. Africa, Senegal, Madagascar, Mauritius.

xi. ANTHEPHORA, F.C. 440 ; F.T.A. 16.

1. **A. Hochstetteri**, *Nees* in *Flora* (1844), 249.

Ovamboland : Oshando, *Schinz*, 611. Damaraland : Otavifontein, acc. to *Heering*.

GENERAL DISTRIBUTION : Tropical Africa, Abyssinia.

2. **A. pubescens**, *Nees*. F.C. 440.

Ovamboland : grass veld round Andoni, *Barnard*, 16488 ! ; Damaraland : Okahandja, *Dinter*, 1116 ; between Gobabis and Gaikus, *Gillman*, 16433 ! ; Nuragas, uncommon, *Lightfoot*, 16505 ! 12738 ! ; dunes east of Gobabis (*Wilman*), between Tsumeb and Bobos (*Dinter*) ; on quartz gravel on Okongawa Mts. near Ovikokorero (*Dinter*) ; in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*) ; Waldau,

*Dinter*, 441 ! Namaqualand : Kamms River side, gravelly places, 1400 m., flowering May, *Range*, 325 ! ; S. of Aminius, sandy places, 1250 m., flowering Nov., *Range*, 771 ! ; Kunab, Bethany District, in black sand, April, *Range*, 1002 ! ; Eastern Karasberg, Narudas Süd, *Pearson*, 8535 ! ; Little Karas Mts., western foothills near Holoog, on sandy bank of stream, *Pearson*, 9739 ! ; between Haris and Awas Mts., *Pearson*, 9502 ! ; Grundoorn, *Pearson*, 3126 ! ; *Lüderitz*, 35 ; Onanisfluss, *Belek*, 63b.

Very good fodder grass for all animals.

4. **A. undulatifolia**, *Hack.* F.C. 441.

Ovamboland : Cunene banks, *Barnard*, 37 ! Damaraland : on limestone at Franzfontein, *Dinter*, 2634 ! ; Okahandja, *Dinter*, 418 ! ; Rehoboth-Aub (*Dinter*) ; Reheboth, *Fleck*.

Found in various places, especially sand, and is preferably fodder for cattle.

3. **A. Schinzii**, *Hack.* in Verhandl. Bot. Ver. Brandenb. 30, 139 (1889).

Ovamboland : Olukonda near Ondonga, *Schinz*, 610.

xii. PENNISETUM, F.C. 430 ; F.T.A. 16.

1. **P. cenchroides**, *Rich.* F.C. 433.

Ovamboland : Uwuthija, *Barnard*, 38 ! ; Andoni, *Barnard*, 16523 ! 16430 ! 39 ! Damaraland : in Kamelbaumbusch on stiff loam at Ovikokorero ; in quartz gravel on Okongawa Mt. near Ovikokorero (*Dinter*) ; in Omaheke Island at Otjonzonjati near Okahandja (*Dinter*) ; in black humus in fissures of limestone in Kamelbaum steppe at Enguruwau (*Dinter*) ; on granite near Okahandja (*Dinter*) ; in large clumps in slightly brackish flats near Okahandja (*Dinter*). Namaqualand : Kuibis, 1350 m., May, *Range*, 657 ! ; Kamms, 1410 m., river-side, Jan., *Range*, 902 ! ; Kunab, Bethany District, 1300 m., black sand, April, *Range*, 1409 ! ; between Windhuk and Gobabis, *Gillman*, 16430 ! ; among stones in river bed at Buchholzbrunn, *Pearson*, 3648 ! ; between Dabaigabis and Grundoorn, *Pearson*, 3116 ! ; in sandy places recently washed by rain, 20 km. south of Warmbad, *Pearson*, 4032 ! ; Gawaichab, banks of the Löwen River, *Pearson*, 4095 ! ; among rocks in dry stream bed near Dabaigabis, *Pearson*, 4389 ! ; Akam River, among quartzite blocks, *Pearson*, 4730 ! ; crevices in kopje near crossing of the Kalkfontein railway track, *Pearson*, 4572 ! 4567 ! ; Eastern Karasberg, among stones on steep hillside, Narudas Süd, *Pearson*, 8131 ! ; Haikamchab, *Galpin* and *Pearson*,

7437 !; Windhuk, common on slopes, *Pearson*, 9361 !; Awas Mts. between Arib and Windhuk, *Pearson*, 9648; Naukluft Mts. at Kabiras among granite blocks, *Pearson*, 9062 !; Little Karas Mts., western foothills near Holoog in sandy banks of Usib River, *Pearson*, 9316 !; S. of Choaberib, on stony plains, *Pearson*, 9450 !; Löwen River, *Range*, 438 !; Farm Gras, Nonikam, acc. to *Heering* and *Grimme*.

Frequent, esp. in stony places, good fodder for all animals.

GENERAL DISTRIBUTION: Throughout Africa, in Sicily, and eastwards as far as North-West India.

2. **P. Stapfianum**, *Bol. f.* in Ann. Bol. Herb. i, 108 (1915).

Namaqualand: Central Karasberg, summit of Scharfenstein, *Pearson*, 8556 !

3. **P. Rangei**, *Mez*, n. sp., in Engl. Jahrb. lvii, p. 185.

Namaqualand: Löwen River, *Range*, 438 !

4. **P. Foermerianum**, *Leeke*, Zeitschr. Naturwiss. lxxix (1907).

Damaraland: on granite near Okahandja (*Dinter*); Otjimbingue, Windhoek, Awasberg, Regenstein, *Albers*, 170, 363.

GENERAL DISTRIBUTION: Mascarene Islands and South Africa.

5. **P. Thunbergii**, *Kunth*. F.C. 436.

Namaqualand: Keetmanshoop, *Fenchel*, 3. Hereroland: *Lüderitz*, 50; *Hoffner*, 84.

GENERAL DISTRIBUTION: Cape Colony, Kalahari, and Eastern Region. A promising perennial grass of wet lands.

6. **P. typhoideum**, *Rich.* F.C. 432.

Ovamboland: Olukonda, *Schinz*, 404; *Rautanen*, 47.

GENERAL DISTRIBUTION: Cultivated very largely in Amboland and tropical Africa.

7. **P. purpurascens** (*Schrad.*) Anderss. in Peters Reise n. Mosamb. ii (1864), p. 522; Dur. et Schinz, Consp. v., p. 783.

Namaqualand: Kuisib, *Fleck*, 525; without locality, *Hoffner*, 84.

GENERAL DISTRIBUTION: Cape Colony, Zambesi, Natal.

8. **P. Myurus**, *Parl.* ex Webb in Hook. Nig. Fl. (1849), p. 183; Dur. et Schinz, Consp. v, p. 781.

Ovamboland: Oshando, *Schinz*, 609.

9. **P. pentastachyum**, *Hochst.* in Schimp. Pl. Abyss., sect. I, n. 315, Dur. et Schinz, Consp. v, p. 782.

Namaqualand: Reheboth, *Fleck*, 25.



## ARUNDINELLEAE.

## i. ARUNDO, F.C. 539.

1. **A. Donax**, *Linn.* F.C. 540.

Namaqualand : Haikamchab, *Galpin* and *Pearson*, 7433 !

The stems are used for whips and the young shoots yield fodder for all animals (*Pilger* in *Notizbl. Bot. Gart. Berlin*, v, No. 46).

## ii. TRICHOPTERYX, F.C. 449 ; F.T.A. 17.

1. **T. Dinteri**, *Pilg.* in *Engl. Jahrb.* ii, 414 (1914).

Damaraland : Gaub, Heisib-Omo, *Dinter*, 2438.

**T. sp. nov.**, *Barnard* (Cunene Gt. Falls), 40 ! (*Range* !).

2. **T. flavida**, *Stapf.* F.C. 451.

Namaqualand : Central and Eastern Karasberg, between Narudas Nord and Krai Kluft, *Pearson*, 8491 ! ; in clefts in granite on foot-hills, Narudas Süd, *Pearson*, 8490 !

GENERAL DISTRIBUTION : Kalahari Region, Transvaal, Pretoria.

3. **T. ramosa**, *Stapf.* F.C. 451.

Damaraland : on Okongawa Mt. near Ovikokorero, on quartz gravel (*Dinter*) ; Waterberg, *Dinter*, 1804 ! ; Karibib, *Dinter*, 2510 ! ; Aris, *Dinter*, 2241 ! Namaqualand : Kamms, *Range*, 903 ! ; Bülls-poort, *Dinter*, 2115 !

GENERAL DISTRIBUTION : Kalahari Region : Griqualand West.

## AVENEAE.

## i. PENTASCHISTIS, F.C. 480 ; F.T.A. 17.

1. **P. airioides**, *Stapf.* F.C. 511.

Namaqualand : Kuibis, 1600 m., flowering October, *Range*, 88 ! A. 35 !

GENERAL DISTRIBUTION : Cape Region, Cape Division, Lion's Head, etc.

## ii. DANTHONIA, F.C. 516 ; F.T.A. 17.

1. **D. pumila**, *Nees.* F.C. 530.

Namaqualand : Pomona, *Dinter*, 4018 ! ; *Range*, 1893 ! ; rocky flora of Nautilusberg, *Range*, 10 ! ; (near Lüderitzbucht), Angra Pequenas, *Galpin* and *Pearson*, 7588 ! ; Lüderitzbucht, *Dinter*, 1260 ! Hereroland : *Nels*, 74.

GENERAL DISTRIBUTION : Cape Colony.



2. **D. tenella**, *Nees*. F.C. 531.

Namaqualand : Kubib, 1600 m., Oct., *Range*, 88 ! A. 35 !

GENERAL DISTRIBUTION : South Africa.

3. **D. suffrutescens**, *Stapf*. F.C. 533.

Namaqualand : Sandverhaar, sand dunes, *Pearson*, 6441 ! 3707 ; common in sand dunes at Gorup, *Pearson*, 496 !

GENERAL DISTRIBUTION : Central Region, Carnarvon Div., and Prieska Div.

4. **D. glauca**, *Nees*. F.C. 534.

Namaqualand : Covinberg, 600 m., Jan., *Range*, 180 ! ; sandy dunes W. of Aubis, 1200 m., Sept., *Range*, 749 ! ; Bethany District, black sand at Kunab, 1300 m., April, *Range*, 1020 ! ; dunes near Elephant River near Gibeon, 1200 m., May, *Range*, 1439 ! ; river sand dunes, 50 km. W. of Kuibis near Lüderitzbucht, June, *Range*, 1829 ! ; on dunes between Garib and Klein Nauas, *Dinter*, 1947 !

Var. **lasiophylla**. Rotekuppe, *Dinter*, 1125 !

GENERAL DISTRIBUTION : Western Region.

5. **D. Rangei**, *Pilg.* in Engl. Jahrb. xlii, 386 (1909).

Namaqualand : Aus, 1300 m., Oct., *Range*, 89 ! ; river bed in mesembryanthemum steppe at Aus, *Dinter*, 1173 !

iii. PHRAGMITES, F.C. 540.

1. **P. communis**, *Trin.* F.C. 541.

Damaraland : Namutoni, round a water hole, *Barnard*, 16526 ! ; creeping with long stolons near Swakop River mouth (*Dinter*). Okosongominja, *Dinter*, 1778. Namaqualand : Bethany, 1000 m., March, *Range*, 1261 ! ; Gibeon ; Anobtal near Swartfontein, 1200 m., May, *Range*, 1837.

Var. **isiaca**, *Coss.* Namaqualand : Homeib, *Schinz*, 612. Hereroland : Lüderitz, 44 ; Kuisib, *Fleck*, 685.

GENERAL DISTRIBUTION : North Africa, Abyssinia, Cape Colony, Spain, S. France.

AGROSTEAEE.

i. POLYPOGON, F.C. 543 ; F.T.A. 18.

1. **P. monspeliensis**, *Desf.* F.C. 543.

Namaqualand : Seeheim, *Dinter*, 4213 ! ; Warmbad, *Wandres*, 10. Hereroland : Lüderitz, 36 ; Tsoachaubtal, *Schenck*, 412. Damara-land : Swakop River, Sept., *Range*, S. 7, 31 !

Very common throughout the Mediterranean region to India, introduced into most warm countries.

ii. AGROSTIS, F.C. 545; F.T.A. 18.

2. **A. Bergiana**, *Trin.* F.C. 547.

Namaqualand: Kuibis, on cultivated ground, July, *Range*, 643!

GENERAL DISTRIBUTION: Coast Region, Eastern Kalahari, also in St. Helena.

STIPEAE.

i. ARISTIDA, F.C. 551; F.T.A. 18.

1. **A. adscensionis**, *Linn.* F.C. 554.

Ovamboland: Cunene banks, *Barnard*, 41!; Namaqualand: Kuibis, quartz rock, 1400 m., May, *Range*, 652!; Bethany District, black sand at Kunab, 1300 m., April, *Range*, 1007!; Fish River, sandstone at Kainuchas near Gibeon, 1200 m., April, *Range*, 1399!; sandy places near Schakalskuppe, 1500 m., March, *Range*, 1779!; Great Karasberg, *Pearson*, 8493!; Grundoorn, *Pearson*, 3129!; sandy grass-steppe at Eahero, *Dinter*, 3406!; in Aristida-steppe near Quartel (*Dinter*).

Common in most dry and hot countries.

**A. adscensionis**, L. var. *coerulescens* (Trin. et Rupr.), Dur. et Schinz, *Consp.* v (1894), p. 799.

Damaraland: in low plains near Otjimbingue, *Marloth*, 1379.

GENERAL DISTRIBUTION: Africa, with the exception of the Sudan; also in Asia and Australia.

2. **A. alopecuroides**, *Hack.* in Verh. Bot. Ver. Prov. Brand. xxx (1888).

Ovamboland: Olukonda, *Schinz*, 656.

2a. **A. altissima**, *Arech.* in Anal. Mus. Montevid. iv, i, 80.

Damaraland: Eahero, on stiff sandy loam, March, *Dinter*, 3281! (very near **A. adscensionis**, *Linn.*).

GENERAL DISTRIBUTION: Uruguay.

3. **A. barbicollis**, *Trin.* and *Rupr.* F.C. 559.

Damaraland: on sandy plateau between Hoffnungsfelde and Haris, *Pearson*, 9542.

A hard, wiry, and practically useless grass.

4. **A. brevifolia**, *Steud.* F.C. 570.

S.W.A. No locality, *Range*, 1233 ! Namaqualand : in southern part, *Fleck*, 290a.

GENERAL DISTRIBUTION : Central Region, Calvinia, Prince Albert.

5. **A. ciliata**, *Desf.* F.C. 563.

Namaqualand : Lüderitzbucht, rocky ground, Jan., *Range*, 204 ! ; Kubib, meadow-forming grass, March, *Range*, 222 ! ; Garub, gravelly places, 900 m., Oct., *Range*, 522 ! ; Kuibis, quartz rocks, 1400 m., May, *Range*, 654 ! ; near Lüderitzbucht, 700 m., Nov., *Range*, 1064 ! ; Tsumeb, sandy places, 1300 m., Sept., *Range*, 1132 ! ; Kainushas, Fish River, sandstone near Gibeon, 1200 m., April, *Range*, 1413 ! ; sand dunes near Elephant River, Gibeon, 1200 m., May, *Range*, 1429 ! ; near Lüderitzbucht, 90 m., March, *Range*, 1556 ! 1564 ; sandy places near Lüderitzbucht, 300 m., Sept., *Range*, 1883 ! ; Central Karasberg in coarse sand on bank of dry watercourse, Krai Kluft, *Pearson*, 8496 ! Damaraland : on white sand dunes at Witvlei, *Dinter*, 1972 ! ; Haikamchab, *Galpin* and *Pearson*, 7424 ! 7413 !

GENERAL DISTRIBUTION : Coast Region, Central, Western and Kalahari Region. Also in Nubia and throughout southern part of Mediterranean region ; on sand and on rocky places ; good fodder.

Var. **villosa**. Damaraland : Kubas-Habis, loamy sand, *Dinter*, 2816 ! Namaqualand : Orab-Mariental, sandstone, *Dinter*, 2013 !

6. **A. coma-ardeae**, *Mez* in Fedde Repert. xvii, p. 152.

Damaraland (*Galpin* and *Pearson*).

7. **A. congesta**, *Roem* and *Schult.* F.C. 558.

Namaqualand : In Aristida-steppe near Quartel (*Dinter*) ; sandy places W. of Naossonabis, 1250 m., Nov., *Range*, 801 ! Damaraland : Awas Mts. in pass between Haris and Aub, *Pearson*, 9542 ! ; *Lüderitz*, 41, 65.

GENERAL DISTRIBUTION : Cape Colony, Transvaal, Orange Free State, Natal, Bechuanaland.

8. **A. damarensis**, *Mez* in Fedde Repert. xvii, p. 512.

Damaraland (*Galpin* and *Pearson*).

9. **A. Dinteri**, *Hack.* in Bull. Herb. Boiss., ser. II, i, 767.

Damaraland : in acacia-steppe in desert between Karibib and Welwitsch (*Dinter*). Hereroland : Kan, *Dinter*, 1485.

10. **A. Dregeana**, *Trin.* and *Rupr.* F.C. 569.

Namaqualand : Lüderitzbucht, in rocky places, Oct., *Range*, 8 ! ; Sept., *Range*, 491 ! Hereroland : *Lüderitz*, 64, Cape Colony.

The so-called "Toa grass" of travelling merchants of Namaqualand, valued as fodder.

11. **A. Engleri**, *Mez* in Fedde Repert. xvii, p. 147.

Namaqualand: Kuibis, *Engler*, 6371.

12. **A. garubensis**, *Pilg.* in Engl. Jahrb. xlviii, 344 (1912).

Namaqualand: Gravelly and rocky places, Garub, 900 m., Oct., *Range*, 508! 536!; granitic rocks near Lüderitzbucht, 800 m., Oct., *Range*, 1069!

13. **A. gonatostachys**, *Pilg.* in Engl. Jahrb. xlviii, 343 (1912).

Namaqualand: Rotekuppe, 400 m., Jan., *Range*, 188; sandy places near Lüderitzbucht, 600 m., Sept., *Range*, 1177; Namib, in sand, *Dinter*, 1022.

14. **A. geminifolia**, *Trin.* and *Rupr.* F.C. 570.

Namaqualand: S. of Obib, 500 m., Aug., *Range*, 586!; gravelly places near Lüderitzbucht, 500 m., Sept., *Range*, 1874!; between Kalkfontein and Nakob, in sandy places, *Pearson*, 9709!; Halusberg, *Dinter*, 4099!

15. **A. Hermanni**, *Mez* in Fedde Repert. xvii, p. 153.

Angra Pequenas (*Hermann*).

16. **A. hirtigluma**, *Steud.* in Syn. Pl. Glum, i, 144.

Namaqualand: sandy places near Gibeon, 1000 m., April, *Range*, 1327!; dunes near S. Kalahari and Elephant River near Gibeon, 1200 m., May, *Range*, 1434!; Fish River, sandstone near Gibeon, 1200 m., April, *Range*, 1408!; on stony soil at Bullsport, *Dinter*, 2136! Damaraland: Tsumeb, *Dinter*, 3310!; Okaharui, *Dinter*, 2074!

GENERAL DISTRIBUTION: Arabia and Syria, N. and N.E. Africa.

17. **A. Hochstetteriana**, *Beck* ex Hack. F.C. 571.

Namaqualand: sandy places near Gibeon, 1000 m., April, *Range*, 1328a!; near Gibeon, Fish River, sandstone, 1200 m., April, *Range*, 1415!; common along shallow stream courses 12 km. W. of Sandverhaar, *Pearson*, 4605!; Haikamchab, *Galpin* and *Pearson*, 7435! 7594; Quartel, near Reheboth, *Dinter*, 2172!; on granite 114 km. from old railway?, *Dinter*, 2820!; *Lüderitz*, 66.

Good fodder grass, but not widely distributed—in sandy places, apparently scattered and rare.

18. **A. hordacea**, *Kunth.* Rév. Gram. ii, t. 173.

Damaraland: Tsumeb (*Dinter*).

19. **A. lanipes**, *Mez* in Fedde Repert. xvii, p. 153.

Namaqualand : Kuibis (*Range*).

20. **A. lutescens**, *Trin.* and *Rupr.* F.C. 567.

Namaqualand : dunes S. of Obib, 400 m., Aug., *Range*, 587 ! ; between Nauchas and Areb, on plains of granitic sand, *Pearson*, 9023 !

Var. **Marlothii**, *Hack.* in Engl. Jahrb. xi, 400. F.C. 567.

Namaqualand : Kuibis River and sand dunes near Lüderitzbucht, 500 m., Feb., *Range*, 1830. Damaraland : Walfish Bay, *Marloth*, 1176 !

21. **A. Marlothii**, *Hack.* in Engl. Jahrb. xi, 402 (1889).

Damaraland : in dunes near mouth, Walfish Bay, *Marloth*, 1039a, April.

This may be a variety of *A. lutescens*.

22. **A. namaquensis**, *Trin.* F.C. 566.

Namaqualand : up to 1 metre high, very common on borders of Fish River near Orab, *Dinter*, 2027 ! ; Kamms River side, 1450 m., Jan., *Range*, 899 ! ; near Lüderitzbucht, 770 m., Oct., *Range*, 1062 ! ; sandy dunes W. of Aubis, 1200 m., Sept., *Range*, 748 ! ; east of Cövenberg, 500 m., Jan., *Range*, 181 ! ; Little Karas Mts., western foothills near Holoog on sandy banks of streams, *Pearson*, 9745 ! ; Holoog, in sandy river bed, *Pearson*, 9714 ! ; below Ababes, in bed of Tsondeb River, *Pearson*, 9155 ! Western and Central Karasberg : dry sandy river bed on high plateau between Krai Kluft and Wasser fall, *Pearson*, 8497 ! ; common in sandy ravines, Wasserfall, *Pearson*, 8078 ! Damaraland : Haikamchab, *Galpin* and *Pearson*, 7426 ! ; Narris, acc. to *Heering*. Damaraland : in large aggregations on white sand at Swakop (*Dinter*).

A widely spread hard and tenacious fodder grass.

GENERAL DISTRIBUTION : South Africa, Coast, Western and Kalahari Regions.

23. **A. obtusa**, *Del.* F.C. 567.

Namaqualand : Garub, 95 km. from Lüderitzbucht, *Dinter*, 1056 ! ; in Aristida-steppe near Quartel, *Dinter*, 2171 ! 2166 ! on stony soil at Bullsport, *Dinter*, 2137 ! ; Lidfontein, *Dinter*, 1999 ! ; Maltahöhe (*Dinter*) ; no locality, *Range*, A. 37 ! 90 ! ; Kubib, *Range*, 234 ! ; sandy places, Garub, 900 m., Oct., *Range*, 523 ! ; near Wittputz, 1000 m., Aug., *Range*, 587 ! ; dunes W. of Aubis, 1200 m., Sept., *Range*, 753 ! ; Namib near Kausib, 400 m., Sept., *Range*, 1133 ! ; near Gibeon, Fish River, sandstone, 1200 m., April, *Range*, 1410 ! 1411 ! ; sand dunes near Gibeon, 1250 m., May, *Range*, 1422 ! ; sand dunes S. of Kalahari and



Elephant River, 1200 m., May, *Range*, 1440 !; near Lüderitzbucht, 90 m., April, *Range*, 1560 !; sandy places near Schakalskuppe, 1500 m., March, *Range*, 1780 ; near Lüderitzbucht, 400 m., Sept., *Range*, 1897 ! Central and Eastern Karasberg: on sandy plains, Krai Kluff, *Pearson*, 8494 !; among granite blocks in ravine, Narudas Süd, *Pearson*, 8498 !; sandy plains N.E. of Narudas Süd, *Pearson*, 8146 ; Gorup, *Pearson*, 4197 !; North of Raman's Drift, *Pearson*, 4009, 4053 !; Schakalskuppe, *Pearson*, 4778 !; between Gamis and Bulls Mouth Pass, in bed of Great Fish River, *Pearson*, 8939 !; Little Karas Mts., western foothills near Holoog, in sandy river bed, *Pearson*, 9725 !; at Kubib on vlei ground, *Pearson*, 9492 ! 9496 !; between Choaberib and Gurumanas, in dry stream bed, *Pearson*, 9598 !; Daunabis, *Pearson*, 6006 ! Hereroland: *Nels*, 72.

Very good fodder grass. Characteristic grass of sandy stretches.

GENERAL DISTRIBUTION: Coast, Central, Western, Kalahari Regions, N. Africa.

24. **A. prodigiosa**, *Welw.* in Trans. Linn. Soc. xxvii (1869), 80.

Namaqualand: Lüderitzbucht, *Schinz*, 663 ; on Nautilus peak, *Schinz*, 664. Ovamboland: Olukonda, *Schinz*, 649.

GENERAL DISTRIBUTION: Mossamedes.

25. **A. pungens**, *Desf.*, Fl. atlant. i (1798), t. xxxv, p. 109.

Namaqualand: Aus, *Schenck*, 171

GENERAL DISTRIBUTION: Egypt, Nubia, Turkestan, and Siberia.

26. **A. Rangei**, *Pilg.* in Engl. Jahrb. xlviii, 344 (1912).

Namaqualand: Kuibis, quartz rocks, 1400 m., May, *Range*, 647 !; rocky places, district Bethany, 1600 m., March, *Range*, 1270 !

27. **A. rigidiseta**, *Pilg.* in Engl. Jahrb. li, 413 (1914).

Damaraland: between Okahandja and Otjisaru, *Dinter*, 2535 ; Okahandja (Grossert), *Dinter*, 1551 ; Omuramba and Omataka, *Seiner*, 691a ; in Omaheke Island at Okaharui (*Dinter*).

28. **A. sabulicola**, *Pilger* in Engl. Jahrb. xl, 81 (1907).

Namaqualand: Elymus, 200 m., Jan., *Range*, 174 !; Covinberg, Jan., *Range*, 179 ! 209 !; Kuisib, *Gurich*, 119-122.

Damaraland: dunes near Rooëbank and Walfish Bay, *Schultz*, 379.

29. **A. Schaferi**, *Mez* in Fedde Repert. xvii, p. 152.

Namaqualand: near Pomona (*Schafer*).

30. **A. sieberiana**, *Trin.* F.C. 560.

Namaqualand: Gibeon; sandy places near Uriab near Kalkfontein Nord, 1200 m., May, *Range*, 1431 !



GENERAL DISTRIBUTION: Transvaal, Delagoa Bay, also in Kordofan and in Southern Palestine.

31. **A. stipitata**, *Hack.* in Verh. Bot. Ver. Brand. xxx (1888), p. 243.

Ovamboland: Omatope, *Schinz*, 658.

32. **A. stipoides**, *Lam.* F.C. 562.

Var. **meridionalis** (*Stapf*).

Ovamboland: Mafa, *Barnard*, 16514! 16470! 16503!; Onolongo, grass-steppe, *Barnard*, 42! Damaraland: Outjo-Nungobeis (*Dinter*); grass-steppe Eahero-Enguruwaw, *Dinter*, 3272! Namaqualand: Aubis, sandy dunes, 1200 m., Sept., *Range*, 754! Central and Eastern Karasberg: summit of Scharfenstein, *Pearson*, 8494!; stony flat on river bank, Keiap River, Narudas Süd, *Pearson*, 8307!; Upper slopes, Narudas Süd, *Pearson*, 8182!; Great Karsberg, *Pearson*, 8495!

GENERAL DISTRIBUTION: Kalahari Region and Northern Bechuanaland.

33. **A. subacaulis**, *Steud.* F.C. 568.

Namaqualand: near Lüderitzbucht, sandy places, 500 m., Sept., *Range*, 1131!; Welwitsch, *Galpin* and *Pearson*, 7466!; Halusberg, *Dinter*, 4104!; Autabib, Garob, *Dinter*, 1961! Hereroland: *Nels*, 73.

GENERAL DISTRIBUTION: Cape Colony.

34. **A. uniplumis**, *Licht.* F.C. 569.

Ovamboland: grassveld round Andoni, *Barnard*, 16492!; Omatope, *Schinz*, 659. Damaraland: in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*); Awas Mts. near Windhoek, *Pearson*, 9649!; Windhoek on shale slope, *Pearson*, 9628!; Otjitambi, Great Barmen, Dabib, Narris, Nord Anias, Otavifontein, farm grass (*Heering* and *Grimme*); railway embankment Okahandja (*Dinter*); Otjimbingue, *Marloth*, 1330. Namaqualand: Kuija, sandy places, 1300 m., May, *Range*, 656!; dunes west of Aubis, 1200 m., Sept., *Range*, 750!; sandy places west of Naissouabis, 1200 m., Nov., *Range*, 802!; Kunab, black sand, April, *Range*, 1015!; near Gibeon, Fish River sandstone, 1200 m., April, *Range*, 1412! 1414! 1417!; dunes near Elephant River, 1200 m., May, *Range*, 1432!; between Ganaams and Voigtsgrund on dry plains, *Pearson*, 9364!; N. of Choaberib in dry stream bed, *Pearson*, 9413!; between Voigtsgrund and Brekdorn, *Pearson*, 9350!; Little Karas Mts., western foothills near Holoog, in sandy river bed, *Pearson*, 9724!; Ababis, on granitic gravel, *Pearson*, 9174!; between Taubgans and Ganaams in stream bed, *Pearson*, 9390!;

between Gamis and Bullsport in river bed of Upper Fish River, *Pearson*, 8940 !; on hills behind Gamis farmhouse, among rocks, *Pearson*, 8973 !; above Ababis in bed of Tsondab River, *Pearson*, 9182 !; Western and Central Karasberg, rough quartz-strewn slopes 200 ft. above Wasserfall Alt, and in dry sandy watercourse on slopes between Wasserfall Alt and Dassiefontein, *Pearson*, 7755 !; broad dry sandy watercourse between Kraai Kluit and Wasserfall, *Pearson*, 8500 !; sandy slope near Kraai Kluit, *Pearson*, 8499 !

Distributed throughout stony and sandy places; abundant in large masses; good fodder for all animals.

GENERAL DISTRIBUTION: Central and Kalahari Regions.

Var. **Neesii**, *Walp.*, *Annal bot.* i (1852), p. 750.

Namaqualand: Lüderitzhafen, *Schinz*, 662. Ovamboland: Oshando, abundant in valleys, *Schinz*, 661.

35. **A. vestita**, *Thbg.* F.C. 561.

Namaqualand: Kuibis, quartzite, 1350 m., Jan., *Range*, 891 !; Bethany, black sand at Kunab, 1300 m., April, *Range*, 1013 !; S. of Kuibis, April, *Range*, 271 !; Grundoon, *Pearson*, 4554; Dabaigabis, *Pearson*, 4406; Alewijnfontein, *Pearson*, 3487.

Good fodder grass.

Var. **diffusa**, *Walp.* Hereroland: *Nels*; "material incomplete, and determination insufficient."

36. *A species very near Burkei*, *Stapf.* F.C. 557.

ii. STIPA.

1. **S. namaquensis**, *Pilg.* in *Engl. Jahrb.* li, 412 (1914).

Namaqualand: Keetmanshoop, in white sand, *Dinter*, 2602.

2. **S. parvula**, *Nees.* F.C. 573.

Namaqualand: Near Haikamehab, April, *Marloth*, 1202.

GENERAL DISTRIBUTION: Cape Colony.

ZOYSIEAE.

i. TRAGUS, F.C. 576; F.T.A. 18.

1. **T. pedunculatus**, *Pilg.* in *Engl. Jahrb.* xlv, 208 (1910).

Damaraland: Grootfontein, *Dinter*, 689.

2. **T. racemosus**, *All.* F.C. 577.

Ovamboland: Mafa, *Barnard*, 16457. Damaraland: Gross Barmen (*Heering* and *Grimme*); Okahandja, in dry river beds and

on mica schist (*Dinter*); Okongawa Mt., on quartz soil (*Dinter*).  
Namaqualand: Kuibis, in cultivated ground, *Range*, 843, 968.

A useless annual, which is injurious to wool.

GENERAL DISTRIBUTION: Throughout the warm regions of both hemispheres.

Var. **Berteronianus** (Schult), *Hack.*

Damaraland: characteristic flora of mica schists of Okahandja (*Dinter*).

Good cattle fodder.

ii. PEROTIS, F.C. 575; F.T.A. 19.

1. **P. latifolia**, *Ait.* F.C. *loc. cit.*

Damaraland: In Omaheke formation of Otjitjika, *Dinter*, 2318! 2865!; Gaube in Omaheke formation, *Dinter*, 2432!; Waterberg plateau, *Dinter*, 584.

Good cattle fodder.

GENERAL DISTRIBUTION: Tropics of the Old World.

iii. MONELYTRUM, F.T.A. 19.

1. **M. Luderitzianum**, *Hack.* in Verhandl. Bot. Ver. Brandenb. 30, 140 (1889).

Damaraland: Namutoni, in low brackish swamps, *Dinter*, 2292!; in Aristida-steppe near Quartel at Klein Windhuk, *Dinter*, 2174!; Awas Mts. pass between Haris and Aub, *Pearson*, 9673; 12 km. E. of Windhuk, on quartzite, *Pearson*, 9791; *Lüderitz*, 40. Namib: Kaoko, N. of Walfish Bay to Cunene (*Schinz*) in Verhandl., *loc. cit.*

GENERAL DISTRIBUTION: Angola, *Pearson*.

SPOROBOLAE.

i. SPOROBOLUS, F.C. 578; F.T.A. 19.

1. **S. barbata**.

Damaraland: in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*).

2. **S. densissimus**, *Pilg.* in Engl. Jahrb. xliii, 91 (1909).

Damaraland: Okahandja and Barmen, in fine sand, *Dinter*, 546!

3. **S. Engleri**, *Pilg.* in Engl. Jahrb. 51, p. 413.

Namaqualand: in large shallow pools on Karroo-slate plateau at Harebis (*Dinter*); in salty Buschsteppe at Harebis, 40 km. S.W. of Mariental, 1220 m., *Engler*, 6591!; Kamelboom, March, *Dinter*, 2070!

4. **S. festivus**, *Hochst.* ex A. Rich. F.C. 582, var. ?

Damaraland : Gaub (*Dinter*).

GENERAL DISTRIBUTION : Throughout tropical Africa and South Africa.

5. **S. fimbriatus**, *Nees*. F.C. 585.

Damaraland : among quartzite blocks in the Akam River bed, *Pearson*, 4724 !; river bed between Nauchas and Areb, *Pearson*, 9030 !; Okahandja, edge of Cynodon-formation towards the river bed (*Dinter*).

GENERAL DISTRIBUTION : South Africa, from Uitenhage and Graaff Reinet to the Transvaal (Lydenburg) and Natal.

6. **S. inconspicuus**, *Hack.* in Vierteljahrsschs. Nat. Ges. Zürich, lvii, 532 (1912).

Ovamboland : Ovakuanyama, Alma Kestila, 18, II, 1903.

7. **S. indicus**, *R. Br.* Prodr. 170.

Damaraland : Otavifontein, acc. to *Heering* and *Grimme*. Between Gobabis and Sandfontein, *Gillman*, 16443 !

A wiry, tufted, and very strong grass which is usually found on roadsides, old lands, and farmsteads, and spreads rapidly. It is readily eaten by stock when young, but soon becomes too tough and wiry, and is then usually avoided except in scarcity of other food.

8. **S. ioclados**, *Nees*. F.C. 583.

Namaqualand : in chalky places near Lüderitzbucht, 1400 m., *Range*, 997 !; Western Karasberg, in the sandy bed of a watercourse above Wasserfall Alt ravine, *Pearson*, 8478 !

GENERAL DISTRIBUTION : Cape Province, sporadically from Calvinia to Colesberg and Uitenhage.

9. **S. lampranthus**, *Pilg.* in Engl. Jahrb. xlviii, 345 (1912).

Namaqualand : Bethany District ; Soromas, meadow-forming grass, 950 m., March, *Range*, 1263 !; Büllspoort on stony soil, *Dinter*, 2135 ! Damaraland : Karibib, *Dinter*, 2517 !

10. **S. marginatus**, *Hochst.* ex A. Rich.

Namaqualand : with *Eragrostis stenothyrsa*, the only two grasses in Hoachanas, nr. Kl. Nuaus, *Dinter*, 1967 !

11. **S. nebulosus**, *Hack.* in Engl. Jahrb. xi, 402 (1889).

Damaraland : Haikamchab, old river bed, *Pearson*, 502 !; *Marloth*, 1208 ; Great Barmen, Voigtsgrund, acc. to *Heering* and *Grimme*.

12. **Sporobolus panicoides**, *A. Rich.* Tent. Fl. Abyss. ii, 399.

Damaraland: Tsumeb, *Dinter*, 2785! 3039!; in quartz gravel on Huttenberg, *Dinter*, 2786! 1675, 2511; Otavi, *Dinter*, 618!; grain used by natives in famine.

13. **S. pungens**, *Kunth.* F.C. 587.

Namaqualand: in muddy places near Ratford Bay, *Range*, 14!; in gravel near the sea at Lüderitzbucht, *Range*, 1747! 1748! Damaraland: mouth of Swakop River, sand dunes over Walfish Bay, *Pearson*, 3381; *Galpin* and *Pearson*, 7406; Sandfischhafen, *Marloth*, 1517.

GENERAL DISTRIBUTION: This species, in the broad sense understood here, is found on the coasts of most warm countries.

14. **S. Rangei**, *Pilg.* in Engl. Jahrb. xliii, 385 (1909).

Namaqualand: Kamms, 1200 m., Feb., *Range*, 470!; in brackish soil at Enguruwau (*Dinter*).

15. **S. Rehmanni**, *Hack.* in Bull. Herb. Boiss, ser. II, iii, 383.

Damaraland: on hill near river bed, Sandfontein, *Gillman*, 16438!

16. **S. robustus**, *Kunth.* Rév. Gram. ii, 425, t. 126.

Damaraland: mouth of Swakop River, Jan., *Galpin* and *Pearson*, 7401!; Welwitsch, Jan., *Galpin* and *Pearson*, 7430!; mouth of Swakop on sand dunes over Walfish Bay border, *Pearson*, 3371; Haikamehab, *Galpin* and *Pearson*, 7429; in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*).

17. **S. Sladenianus**, *Bol. f.* in Ann. S. Afric. Mus. ix, 236 (1915).

Namaqualand: Central and Eastern Karasberg: high plateau between Narudas Süd and Krai Kluff, *Pearson*, 8103!; sandy plains near Schakalskuppe, *Pearson*, 4779.

18. **S. spicatus**, *Kunth.* Rév. Gram. i, 67.

Ovamboland: Onolongo grass-steppe, *Barnard*, 44! Damaraland: in brackish soil at Enguruwau and Namutoni, *Dinter*, 3392!; in halophyte vegetation, limestone pan at Otjindaura, near Okahandja (*Dinter*).

Insufficiently known species: **S. glaucus**? **S. salsus**? **S. Seineii**? (*Dinter*).

## ERAGROSTEAEE.

### i. POGONARTHRIA, F.C. 589; F.T.A. 19.

1. **P. falcata**, *Rendle.* F.C. 589.

Ovamboland: Namakunde, *Barnard*, 46!; Cunene banks, *Barnard*, 46a!; *Barnard*, 16473. Damaraland: Tsumeb (*Dinter*).



GENERAL DISTRIBUTION: Kalahari Region, Griqualand West; Orange Free State, Transvaal, Eastern Region, Natal; also in tropical South Africa as far as the Zambesi.

2. **P. leiarthra**, *Hack.* in Vierteljahrs. Naturf. Ges. Zürich, 57 (1912), Hft. iii.

Ovamboland: Ondonga (*Rautanen*).

3. **P. squarrosa** (*Licht*) *Pilg.* in Notizbl. Bot. Gart. Berlin, 46 (1910), 149.

Damaraland: Tsumeb, on red loam and sand (*Dinter*).

4. **P. tuberculata**, *Pilg.* in Engl. Jahrb. xliii, 92 (1909).

Damaraland: Wilhelmsberg near Okahandja, March, *Dinter*, 2563! 1584! 1625!; Aris, *Dinter*, 2223!; Reheboth to Aub, *Dinter*, 2223!; one of the dominant grasses at Plattsand, N. of Reheboth; on quartz gravel on Okongawa Mt. near Ovikokorero; between Okahandja and Osona. Very good cattle fodder.

## ii. ERAGROSTIS, F.C. 594; F.T.A. 19.

1. **E. angusta**, *Hack.* in Bull. Herb. Boiss, ser. II, i, 772.

Farm Grass (*Heering* and *Grimme*)! Damaraland: Chairrob, in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*); in slightly brackish flats, Okahandja (*Dinter*); Okahandja, *Dinter*, 1618! Namaqualand: Tsoachaub, *Dinter*, 98!

2. **E. annulata**, *Rendle*. F.C. 619.

Ovamboland: grass veld round Andoni, *Barnard*, 16501! Namaqualand: Kuibis, 1320 m., May, *Range*, 662; near Gibeon, on Kalahari chalk near Elephant River, 1200 m., May, *Range*, 1436; Little Karas Mts., western foothills near Holoog, in sandy river bed, *Pearson*, 9729; Holoog, in bed of Great Fish River, *Pearson*, 9702; sandy stream bed on stony plain 12 km. W. of Sandverhaar, 3200 ft., *Pearson*, 4621; dry stream between Dabaigabis and Grundoor, *Pearson*, 3117; sand of stream bed W. of Ganus, *Pearson*, 4477; among quartzite blocks, Akam River basin, *Pearson*, 4757. Damaraland: Karibib, *Dinter*, 2520; Okahandja, *Dinter*, 2549; in Omaheke Island at Otjonzonjati near Okahandja (*Dinter*).

GENERAL DISTRIBUTION: Kalahari Region.

3. **E. aspera**, *Nees*. Fl. Afr. austr. 408.

Damaraland: Tsumeb, *Dinter*, 2913.



4. **E. Atherstonei**, *Stapf*. F.C. 607.

Ovamboland : grass veld round Andoni, *Barnard*, 16511 !; bushveld, Omasere to Ondonga, *Barnard*, 16463 !; Mafa, *Barnard*, 43 ! Damaraland : Sandfontein, *Bleek*, 16476 ! Namaqualand : Eastern Karasberg, among stones on river bed, Narudas Süd, *Pearson*, 8305 !

GENERAL DISTRIBUTION : Transvaal.

5. **E. auriculata**, *Hack.* in *Bull. Herb. Boiss.*, ser. II, i, 773.

Damaraland : Otavifontein (*Heering* and *Grimme*). Namaqualand : Inachab, *Dinter*, 1095 ; Gamis, among rocks on hills behind farm house, *Pearson*, 8974 ; between Gamis and Bulls Mouth Pass, in bed of Upper Fish River, *Pearson*, 8936, 8937 ; Tsoachaub, *Dinter*, 157.

6. **E. bicolor**, *Nees*. F.C. 605.

Namaqualand : between Hoffnungsfelde and Haris in sandy places on high plateau, *Pearson*, 9534 !; Great Karasberg, *Pearson*, 8480 !; Kubib, on vlei ground, *Pearson*, 9484 !; in sand near Kiubis railway station, *Pearson*, 476 !

Var. **flexuosa**, *Nees*. In *Aristida*-steppe near Quartel and Reheboth, *Dinter*, 2156 !; Okakueyo, Grossart in *Herb.*, *Dinter*, 1536.

GENERAL DISTRIBUTION : Central and Kalahari Regions.

7. **E. biflora**, *Hack.* F.C. 610.

Damaraland : Wilhelmsberg, Okahandja, *Dinter*, 2565 !; Otjismangombe, under *Acacia*, *Dinter*, 3355 !; in sand under bushes, Aris-Windhoeck, *Dinter*, 2232 !; near Welwitsch (*Dinter*) ; locality ? *Fleck*, 281a.

GENERAL DISTRIBUTION : Kalahari Region, Orange Free State, Transvaal.

8. **E. brizantha**, *Nees*. F.C. 626.

Namaqualand : Near Gibeon, 1000 m., April, *Range*, 1328b ! 1374 !; Western, Central, and Eastern Karasberg, watercourse above Wasserfall Alt ravine, *Pearson*, 8487 !; clefts in sandstone, Upper Krai Kluft ravine, *Pearson*, 8486 !; rooted among stones in water in Keiap River, Narudas Süd, *Pearson*, 8488 !; river bed near Dabaigabis, *Pearson*, 4383 ; sandy valley (dry river bed), 20 km. N. of Raman's Drift, *Pearson*, 4539 ; Garius, *Dinter*, 4237 ; Seskamel Farm on Leber River (*Dinter*) ; between Ausis and Kuias, *Schenck*, 221 ; Gobaxab, between Aus and Orange River, *Schenck*, 337 ; *Pohle*, 17 ; Inachab, *Dinter*, 11094 ; Tsoachaubmund, *Dinter*, i. 75 ; Satansplatz, *Dinter*, 2044 ; Inachab, *Dinter*, 1105 ; Narib, *Dinter*, 2990. Damaraland : Grootfontein, *Lightfoot*, 12734 !; Witvlei dunes, 1250 m., *Range*, 1421 !

9. **E. brizoides** (L.), *Nees*. F.C. 624.

Damaraland : Okahandja, *Hopfner*, 69.

A sweet fodder grass.

GENERAL DISTRIBUTION : Cape Colony, Transvaal, Natal, Upper Guinea.

10. **E. Burchelli**, *Stapf*. F.C. 608.

Ovamboland : Mafa, *Barnard*, 16484 ! 16512 !

GENERAL DISTRIBUTION : Kalahari Region.

11. **E. chalcantha**, *Trin.* F.C. 615.

Namaqualand : sandy plains S. of Schakalskuppe Station, *Pearson*, 4773. A good sheep grass.

GENERAL DISTRIBUTION : South Africa, Coast Region, Kalahari and Eastern.

12. **E. chloromelas**, *Steud.* F.C. 602.

Namaqualand : Eastern Karasberg, sand in river bed, Narudas Süd, *Pearson*, 8336 !; in Usib River bed 8 km. N.W. of Nomtsas, *Pearson*, 9308 !; south of Choaberib, *Pearson*, 9456 !

GENERAL DISTRIBUTION : Coast, Central, Kalahari, and Eastern Regions.

13. **E. crassinervis**, *Hack.* in Bull. Herb. Boiss., II, i, 774.

Namaqualand : Inachab, *Dinter*, 1099.

14. **E. curvula**, *Nees*. F.C. 599.

Namaqualand : Central Karasberg, summit of Scharfenstein, *Pearson*, 8476 !

Var. *valida*, *Stapf*.

Damaraland : Sandfontein, *Gillman*, 16453 ; Nuragas, *Lightfoot*, 16532.

GENERAL DISTRIBUTION : South Africa, Coast, Central, Eastern and Kalahari Regions. A valuable pasture grass.

15. **E. cylindriflora**, *Hochst.* in Flora, xxxviii (1855), 324. Abyss.

Ovamboland : Cunene banks, *Barnard*, 83 !

16. **E. cyperoides**, *Beauv.* F.C. 611.

Namaqualand : Lüderitzbucht, Jan., *Range*, 14890 ; in S.A.M. ! 15 ! 210 ! 365 !; Angra Pequenas, *Pearson*, 7569 !; *Schin*z, 616 ; *Schenck*, 4 ; in dunes near Sandfish Bay, *Marloth*, 1167.

GENERAL DISTRIBUTION : South Africa, on Milverton dunes taking the place of *Psamma* ; Western Region ; Little Namaqualand.

17. **E. denudata**, Hack. F.C. 613.

Damaraland : between Haris and Awas Mts. in Kimbis River bed, *Pearson*, 950 !; Aris, good fodder grass, *Dinter*, 2239 !; Aris-Windhoek, *Dinter*, 1852 !; Bushveld near Grootfontein, *Dinter*, 2309 !; Oukongo, *Dinter*, 3382 ; on quartz gravel on Okongawa Mt. near Ovikokorero (*Dinter*) ; Gross Tutara-Franzfontein (*Dinter*) ; Kamelboom, *Dinter*, 2068 ! Namaqualand : growing with *Pappophorum brachystachyus* in small cushions about 5 cm. high at Nomtsas (*Dinter*) ; Kubib, *Range*, 233 ! 312 !; Garub, 900 m., Oct., *Range*, 510 !; Kuibis, quartz rocks, 1350 m., May, *Range*, 658 ! 867 ! 892 !; Bethany District : Kunab, 1300 m., April, *Range*, 1400 !; Central and Eastern Karasberg : sandstone plateau on summit of Long Hill east of Krai Kluft, *Pearson*, 8482 ; stony flats S. of Keiap River at Narudas Süd, *Pearson*, 8317 !; Groot Rozijnbosch, *Pearson*, 3696 !; sandy plains of Schakalskuppe, *Pearson*, 4794 ; common in sand near base of kopje 15 miles S.E. of Grundoon, *Pearson*, 4565 ; very common 18 km. W. of Aus, *Pearson*, 4216. Ovamboland : Onolongo, *Barnard*, 51 !; Cunene banks, *Barnard*, 50 !

GENERAL DISTRIBUTION : Kalahari Region, Griqualand West, Bechuanaland, Orange Free State, Transvaal.

18. **E. Dinteri**, Stapf in Kew Bull. 1906, 29.

Damaraland : near Grootfontein, Otjitjika, April, *Dinter*, 1518 !; Ossire, *Dinter*, i, 484 !; characteristic grass of Omaheke formation of Grootfontein, Awas, etc. Okakueyo, *Grossart* in Herb., *Dinter*, 2581, 2582, 2579 ; Otjitjika, *Dinter*, 2882.

19. **E. echinochloidea**, Stapf. F.C. 627.

Damaraland : Namutoni, near water hole, *Barnard*, 54 ! 16504 ! 16496 !; in bed of Omuramba and Ovamba near Kajas (*Dinter*) ; in black humus in fissures of limestone, Okahandja, *Dinter*, 1629 ! Namaqualand : Soromas Vlei, 1000 m., April, *Range*, 664 !

Grows in sandy places, 70-80 cm. high, and is valued as fodder.

GENERAL DISTRIBUTION : Kalahari Region.

20. **E. fastigiata**, Hack. in Bull. Herb. Boiss., ser. II, i, 768.

Namaqualand : Inachab, *Dinter*, 1102.

21. **E. gummiflua**, Nees. F.C. 629.

Damaraland : Otjihangwe, *Dinter*, 2763 !; Aris, *Dinter*, 2240 !; Okahandja Otjisazu, *Dinter*, 2546 !

GENERAL DISTRIBUTION : Coast, Kalahari, and Eastern Regions.

22. **E. hereroensis**, *Hack.* in Bull. Herb. Boiss., ser. II, i, 775.

Damaraland : Nonikam (*Heering* and *Grimme*). Namaqualand : Tsoachaub, *Dinter*, 256.

23. **E. heteromera**, *Stapf.* F.C. 610.

Damaraland : between Gobabis and Sandfontein, *Gillman*, 16442. Namaqualand : Western Karasberg, moist patch of gravel in lateral ravine 100 ft. above Wasserfall Alt, *Pearson*, 8481 !

GENERAL DISTRIBUTION : Eastern Region, Natal, Pietermaritzburg.

24. **E. karasbergensis**, *Bol. f.* in Ann. Bol. Herb., i, 110 (1915).

Namaqualand : Central and Eastern Karasberg ; river bed between Krai Kluff and Narudas Süd, *Pearson*, 8484 ; Narudas Süd, *Pearson*, 8485.

25. **E. Lappula**, *Nees.* F.C. 627.

Ovamboland : grass veld round Andoni, *Barnard*, 16502 ! ; Ono-longo, *Barnard*, 55.

GENERAL DISTRIBUTION : Kalahari and Eastern Region.

Var. **divaricata**, *Stapf.* F.C. 628. Amboland : Olukonda, *Rautanen*.

26. **E. laevisissima**, *Hack.* in Fedde Repert. x, 170 (1911).

Damaraland : Otavifontein (*Heering* and *Grimme* in Arb. d. D. Landw. Ges. 197, p. 3).

27. **E. Lehmanniana**, *Nees.* F.C. 601.

Damaraland : Namutoni, *Barnard*, 16506 ; in bed of stream, Windhuk, *Gillman*, 16437. Namaqualand : near Gibeon, 1200 m., May, *Range*, 1430 ; Bethany, Kunab, April, *Range*, 1011 ; Eastern Karasberg ; amongst granite blocks in ravine, Narudas Süd, *Pearson*, 8477 ; between Haris and Awas Mts. on high plateau, *Pearson*, 9504. Damaraland : between Choaberib and Gurumanas in dry stream bed, *Pearson*, 9409 ; Okajongana, *Dinter*, 1590 !

GENERAL DISTRIBUTION : Central, Kalahari and Eastern Region.

28. **E. leptocalymma**, *Pilg.* in Engl. Jahrb. xl, 84 (1907).

Namaqualand : near Gibeon, riverside, 1200 m., April, *Range*, 1373 ! ; Kalahari, Kohong (Dr. L. Schultze, n. 356b, flowering Jan. 1905), between Sekuma and Kooa (Schultze, n. 342m).

29. **E. longifolia**, *Hochst.* in Flora (1841), 23.

Namaqualand : sandy flats between Ausis and Kuia, *Schenck*, 220.

30. **E. macrochlamys**, *Pilg.* in Engl. Jahrb. xlviii (1912).

Namaqualand : Bullsport, April, *Dinter*, 2140 ! ; Otjisondu, chalk pan, *Dinter*, 3383 ! ; mesembryanthemum steppe at Aus (*Dinter*) ;

Kubub River, April, *Range*, 269 !; Kamms River side, 1450 m., Jan., *Range*, 900 !; near Aris, 1500 m., April, *Range*, 1271 !

31. **E. major**, *Host.* F.C. 620 (*E. multiflora*, Aschers.).

Namaqualand: Orab (*Heering* and *Grimme*). Damaraland: in Omaheke Island at Otjonzonjati near Okahandja (*Dinter*), Okahandja, *Dinter*, 1628; Waterberg, *Dinter*, 1799.

Probably introduced; a native of the Mediterranean regions and India.

GENERAL DISTRIBUTION: Coast, Kalahari, and Eastern Regions.

32. **E. margaritacea**, *Stapf.* F.C. 604.

Namaqualand: Bethany, Kunab, 1300 m., April, *Range*, 1022 !  
Ovamboland: Tamansu, common in all Omurambas, *Barnard*, 50a !;  
Onambeke, apparently rare, *Barnard*, 50 !

GENERAL DISTRIBUTION: Kalahari Region.

33. **E. membranacea**, *Hack.* in Verhandl. Bot. Ver. Brandenb. 30, 148 (1889).

Ovamboland: *Schinz*, 614 (type); between Ondonga and Ovakuanyama, *Rautanen*, 6; between Olukonda and Ovakuanyama, *Rautanen*, 586.

34. **E. micrantha**, *Hack.* F.C. 608.

Namaqualand: Gawachab, near high-water mark on bank of Löwen River, *Pearson*, 4094 !

GENERAL DISTRIBUTION: Orange Free State, Busutoland.

35. **E. monanthe**, *Pilg.*

Damaraland: Kl-Nauas-Hoachanas, in red dunes, *Dinter*, 1946; Tutara-Franzfontein, *Dinter*, 2608.

36. **E. namaquensis**, *Nees.* F.C. 630.

Var. **E. interrupta**, *Beauv.*

Damaraland: Swakopmund, *Dinter*, i, 85; Okahandja, *Dinter*, 7 !; Ourejo, *Dinter*, 1577 !

Var. **robusta**, *Stapf.*

No locality, *Range*, 1253 ! Var. **uninodis**, *Hack.*

Namaqualand: near Keetmanshoop, *Range*, 1319 ! Damaraland: Okahandja Otjisazu, 12 km., *Dinter*, 2560 !; Salem, *Dinter*, i, 140.

GENERAL DISTRIBUTION: Western Kalahari and Eastern Regions.

37. **E. obtusa**, *Munro* ex Ficalho. and Hiern. F.C. 625.

Namaqualand: Central and Eastern Karasberg: sandbank in partial shadow, Keiap River, *Pearson*, 8483 !; Narudas Süd, *Pearson*, 8484 !



GENERAL DISTRIBUTION: South Africa, Coast, Central, and Kalahari Regions.

38. **E. Pilgeriana**, *Dinter* ex Pilger in Engl. Jahrb. li, 420 (1914).

Damaraland: Okahandja, in great quantities, *Dinter*, 1657!

39. **E. pilosa** (L.), *P. Beauv.*, Essai Agrost. (1812), p. 71.

Namaqualand: Lüderitz, 42; Orab (*Heering* and *Grimme*).

GENERAL DISTRIBUTION: Cape to Egypt, S. Europe, Central Asia, and America.

40. **E. plumosa**, *Link.* Hort. Berol. i, 192.

Syn. *E. retinorrhæa*, Steud.; *E. tenella*, R. and S.

Damaraland: Okahandja, *Dinter*, 134; Okandu, *Dinter*, 134; 12 km. from Pad Okahandja-Otjisazu, *Dinter*, 134; Okakueyo, *Grossart* in herb., *Dinter*.

41. **E. porosa**, *Nees*. F.C. 604.

Ovamboland: grass veld round Andoni, *Barnard*, 16491! Damaraland: near Klein Witvlei, Gobabis, *Gillman*, 16445!; Windhoek, in bed of stream, *Gillman*, 16456; Okahandja, *Dinter*, 1624!; between Tsumeb and Bobos (*Dinter*); in Kamelbaumbusch on stiff loam at Ovikokorero (*Dinter*). Namaqualand: Kuibis, 1320 m., May, *Range*, 622! 732! 888!; Leber River, near base of kopje 15 miles S.E. of Grundoon, *Pearson*, 4538, 4561, 4557; sandy stream bed on stony plains 15 km. W. of Sandverhaar, *Pearson*, 4622; among quartzite blocks, Akam River bed, *Pearson*, 4742; on kopje near Grundoon, *Pearson*, 3138; Kunab, 1300 m., *Range*, 1017!; Gibeon, 1200 m., *Range*, 1428; Central Karasberg, among stones on bank of dry stream on plains S.W. of Krai Kluft, *Pearson*, 8479; Hoffnungs-felde, *Pearson*, 6585; Haris, in Kuibis river bed, *Pearson*, 9558; Satansplatz, *Dinter*, 2046! 2043!; Okatjongeama (*Grossarth*), *Dinter*, 1581, 1592!; dominant grass with *Pogonarthria tuberculata* and *Triraphis Fleckii* at Plattsand N. of Reheboth (*Dinter*); Quartel, *Dinter*, 2170; between Ausis and Kujas, *Schenk*, 82.

In sandy places, and along rivers; useful as fodder for all animals.

GENERAL DISTRIBUTION: Coast and Kalahari Regions.

41. **E. porosa**, *Nees*, forma laxa?

Namaqualand: Satansplatz, *Dinter*, 2043!; Lichtenstein, *Dinter*, 4350!

42. **E. procumbens**, *Nees*. F.C. 620.

Namaqualand: Kuibis, 1300 m., May, *Range*, 661!

GENERAL DISTRIBUTION: Central Region, Camdeboo.



43. **E. pusilla**, *Hack.* in Bull. Herb. Boiss. iv (1896), App. III, 27.

Damaraland: Swakopmündung and Tsoachaubmund, *Dinter*, 81.

44. **E. ramosa**, *Hack.* in Bull. Herb. Boiss., ser. II, i, 776 (1901).

Namaqualand: Nonikam (*Heering* and *Grimme*); river bed near Chamis (*Schultze*). Damaraland: Salem, *Dinter*, i. 134.

45. **E. rigidior**, *Pilg.* in Engl. Jahrb. xlviii, 347.

Damaraland: between Okahandja and Osona (*Dinter*), Okahandja (*Grossart*), *Dinter*, 1532, 1635; Waterberg, *Dinter*, 1821, in damp places along streams.

46. **E. sabulicola**, *Pilg.* ex De Wild in Ann. Mus. Congo, ser. V, ii, 15 (1907).

Damaraland: Dunes near Rooibank, Walfish Bay, *Schultze*, 379, April. Namaqualand: dunes in Kuisib, *Gürich*, 119, 122. Nomen in Schlechter Westafr. Kautschuk. Exped. 260.

47. **E. scopelophila**, *Pilg.* in Engl. Jahrb. li, 421 (1914).

Namaqualand: at Tsamkubis on granite, *Dinter*, 2197. Damaraland: in Omaheke Island at Otjonzonjati, near Okahandja, and Okaharui, *Dinter*, 2197; Wilhelmsberg, March, *Dinter*, 2564.

48. **E. spinosa**, *Trin.* F.C. 612.

Namaqualand: Karinberg, *Range*, 182!; sand dunes S. of Obib, 400 m., Aug., *Range*, 588!; Lüderitzbucht, 90 m., July, *Range*, 1557!; *Galpin* and *Pearson*, 7404!; Rotkuppe, 2-ft., sand dunes near top of Mts., *Pearson*, 418; Aris Drift, *Schenck*, 239; Tsoachaubmund, *Dinter*, 14; dry muddy places at Kuisib near Rooibank, *Schultze*, 374. Damaraland: Swakop River, *Pearson*, 505!; growing in masses, Swakop mouth (*Dinter*)!

GENERAL DISTRIBUTION: Coast Region, Central and Western.

49. **E. stenothyrsa**, *Pilg.* in Engl. Jahrb. li, 421 (1914).

Namaqualand: with *Sporobolus marginatus*, the only two grasses at Hoachanas (near Klein Nauas), *Dinter*, 1966.

50. **E. superba**, *Peyr.* F.C. 622.

Ovamboland: Mafa, *Barnard*, 53!; between Ondonga and Ovakuanyama, *Rautanen*, 587. Damaraland: Namutoni, *Barnard*, 16503!; Otavifontein (*Heering* and *Grimme*); in Kamelbaum rock on stiff loam at Ovikokorero and in Omaheke Island at Otjonzonjati, *Dinter*; between Gobabis and Sandfontein, *Gillman*, 16444!; Grootfontein, *Lightfoot*, 12735!; between Hoffnungsfelde and Haris, in sandy places, *Pearson*, 9530!; Awas Mts., Windhoek, *Pearson*,

9646 !; Okahandja, *Dinter*, 1613 ! Namaqualand : in bed of Great Fish River, *Pearson*, 9543 !

Found in dry stony and sandy places. A moderately good hay and pasture grass.

GENERAL DISTRIBUTION : South Africa, Kalahari, Eastern Region.

51. **E. trichophora**, *Coss. et Dur.* in Bull. de France. Soc. Bot. ii. (1855), 311 (*E. papposa*, Steud., Nom. ed. ii, i, 564).

Damaraland : Voigtsgrund, Otavifontein, Otjitjambi (*Heering* and *Grimme*) and (*Schlettwein*), comm. Herb. Hamb.

52. **E. truncata**, *Hack.* F.C. 624.

Namaqualand : on stony soil at Bullsport, *Dinter*, 2138 ! Damaraland : in Aristida-steppe near Quartel, Klein Windhuk, *Dinter*, 2165 !; Otjivero, *Dinter*, 2732 !; Awas Mt., *Dinter*, 1886 !

GENERAL DISTRIBUTION : Central and Kalahari Regions.

53. **E. viscosa**, *Trin.* in Mem. Acad. Petersb., ser. VI, i (1831), 397.

Ovamboland : grass veld round Andoni, *Barnard*, 16464 !; Olukonda, *Schinz*, 636 (*Rautanen*). Damaraland : Okahandja, *Dinter*, 134.

GENERAL DISTRIBUTION : Abyssinia and India, tropical Asia.

### iii. DIPLACHNE, F.C. 590 ; F.T.A. 20.

1. **D. fusca**, *Beauv.* F.C. 591.

Ovamboland : Tamansu, *Barnard*, 59 !; Onambeke, *Barnard*, 60 !; Cunene banks, *Barnard*, 61 !; Andoni, *Barnard*, 70 ! Damaraland : forming meadows near Namutoni, *Dinter*, 2293 ; Oukango, *Dinter*, 3369 ! Namaqualand : near Keiap River side, 900 m., April, *Range*, 1320 !; near Gibeon, 1200 m., April, *Range*, 1375 !; Central and Eastern Karasberg, in shallow drying pools between Narudas Nord and Krai Kluft (camel path), *Pearson*, 8489 !; rooted among stones in water in Keiap River, Narudas Süd, *Pearson*, 8488 !; Gamkanas, *Dinter*, 1992 ; Mariental-Orab, *Dinter*, 2015 ; Leber River near Ses-kamelboom, *Dinter*, 2051.

Widely spread throughout the warm regions of the Old World, mainly near water.

GENERAL DISTRIBUTION : Coast, Central, Western, and Kalahari Regions.

2. **D. Fleckii**, *Hack.* Bull. Herb. Boiss. iv, App. iii, 25.

Namaqualand : Reheboth, *Fleck*.

iv. LEPTOCHLOA, F.T.A. 20.

1. **L. monostachya**, *Roem and Schult.*, Syst. ii, 580.

Damaraland : Tsumeb, *Dinter*, 2483 ! ; Otjitjika, *Dinter*, 2893 !

v. ODYSSEA, in Hook. Icon. Pl. t. 3100.

1. **O. paucinervis**, *Stapf*, loc. cit.

Ovamboland : Onolongo, *Barnard*, 78 ! Namaqualand : near Gibeon, meadow-forming grass, 1200 m., April, *Range*, 1372 ! ; Kalkfontein chalk pan, 1200 m., May, *Range*, 1425 ! Damaraland : Swakop, Sept., *Range*, 36, S. 12 ! ; in saline sandy ground, Barmen (*Lirdner*) ; Haikamchab, *Pearson*, 7439, 7406, 7412, dry bed of Swakop River, *Pearson*, 504 ; *Galpin* and *Pearson*, 7412 ! 7406 ; *Marloth*, 1365 ! ; near brackish water along Etosha Pan, dominant grass on brackish white dunes at head waters of Auob near Lidfontein, *Dinter*, 1994 ; in halophyte vegetation of limestone pans near Okahandja, forming meadows several sq. km. in extent at Namutoni (*Dinter*).

This plant is found in coast dunes and dry river beds, on sand-flats inland in large aggregations. Horses, cattle, sheep, and goats devour it.

CHLORIDEAE.

i. OROPETIUM, F.C. 741 ; F.T.A. 20.

1. **O. capense**, *Stapf*. F.C. 742.

Damaraland : in Omaheke Island at Otjonzonjati, near Okahandja, *Steinhausen*, 2780 ! ; Grootfontein, *Dinter*, 638 ! ; Garub, April, *Range*, 259 ! ; Otjiseva, *Dinter*, 491.

GENERAL DISTRIBUTION : Central and Kalahari Regions.

ii. MICROCHLOA, F.C. 635 : F.T.A. 20.

1. **M. caffra**, *Nees*, Fl. afr. austr. i, 246.

Ovamboland : Olukonda, *Rautanen*.

2. **M. setacea**, *R. Br.* F.C. 636.

Damaraland : Tsumeb, *Dinter*, 645 !

GENERAL DISTRIBUTION : Transvaal and throughout the tropics.

iii. WILKOMMIA, F.T.A. 20.

1. **W. annua**, *Hack.* in Verh. Bot. Ver. Prov. Brand. xxx (1888), 146.

Ovamboland : Olukonda, *Schinz*, 625.

2. *W. sarmentosa*, *Hack.* in Verh. Bot. Ver. Prov. Brand. xxx (1888), 145.

Ovamboland : Mafa, *Barnard*, 62 ; 16452 ! ; Onolonga, *Barnard*, 63 ! ; Olukonda, *Schinz*, 626.

iv. CYNODON, F.C. 633 : F.T.A. 20.

1. *C. dactylon*, *Pers.* F.C. 634.

Ovamboland : Olukonda, *Schinz*, 623 and 624. Namaqualand : West Umkoin, 1300 m., May, *Range*, 479 ! ; Kuibis River side, 1300 m., July, *Range*, 638 ; ! near Keetmanshoop on cultivated land, 900 m., Dec., *Range*, 1613 ! 1614 ! ; Swartfontein, near Gibeon, alluvial bed of Tsondab River, *Pearson*, 9196 ! ; Bethany, in Mission garden, *Schinz*, 388. Damaraland : Otavifontein and Orab (*Heering* and *Grimme*) ; Okahandja, on sandy humus (*Dinter*) ; Windhoek, *Pearson*, 9778 ; *Lüderitz*, 191 ; Swakopmund, *Dinter*, 71.

An important factor in the landscape of Hereroland ; the grass forms dense meadows all along the great rivers where the banks are not occupied by acacia wood, in belts of 150-250 m. along Okahandja River. These meadows are the best indication of abundant water in great depths and heavy loam soil which is so valuable for agriculture. "Kwek gras" forms a dense close carpet, denser than turf of any kind in Germany, and its stolons, which creep horizontally about 10 cms. below the surface, form a dense felt which cannot be disentangled, so close is it that very few plants can compete successfully. It is remarkable in that it spreads as much by seed as by its stolons. When farmers break cynodon land they have to fight for years against thousands of seedlings which spring up again and again ; if neglected, the land goes back in a short time to cynodon meadow (*Dinter* in Bot. Reis. in D.S.W.A. Fedde. Repert. Sp. Nov. Beiheft, Bd. iii, 1921).

*C. dactylon* yields excellent sweet pasturage on abandoned land. In the southern United States and in India it makes good hay, which keeps sweet for years in stack. It grows very freely and to a large size on cultivated land, but is most valued as a sand binder for the walls of dams, etc.

GENERAL DISTRIBUTION : S. Africa, Coast, Kalahari, and Eastern Regions. In Old and New Worlds.

v. ENTEROPOGON, F.T.A. 21.

1. *E. monostachyus* ( *Vahl* ) *Pilg.* (Syn. *E. macrostachyus*, *Munro* ex Bth.).

Damaraland : Tsumeb, *Dinter*, 2483 : Otjitjika, *Dinter*, 2893.

vi. CHLORIS, F.C. 640; F.T.A. 21.

1. **C. barbata**, Sw., Fl. Ind. Occ. i, 200.

Namaqualand: Kuias, *Schinz*, 620; Tiras, *Schinz*, 619. Damara-land: in Okahandja between Okahandja and Osona, *Dinter*, 1632; Ovamboland: Olukonda, *Schinz*, 618.

2. **C. compressa**, D.C., Cat. hort. Mospel. (1813), p. 94.

Namaqualand: Kuisib, *Fleck*, 530.

GENERAL DISTRIBUTION: Cape Colony to Uganda.

3. **C. virgata**, Swartz. F.C. 641.

Ovamboland: Mafa, *Barnard*, 64! 16494! Namaqualand: Bethany District; Kunab, 1300 m., April, in black sand, *Range*, 1006!; Beersheba District, Mukorup Vlei, 1100 m., April, *Range*, 1341!; Kainuchas, near Gibeon, 1200 m., in black sand, April, *Range*, 1376!; Great Kosis, 1130 m., in muddy places, July, *Range*, 386! Damara-land: Tsumeb, *Dinter*, 2493; Windhuk, near native hospital, *Gillman*, 16427!; between Windhoek and Gobabis, *Gillman*, 16432!; Inachab, *Dinter*, I, 1096, 1096a.

Widely spread through the tropics of both hemispheres. An annual weed in old lands, keenly relished by stock, and considered a highly nutritious fodder; it is largely used for hay, in which character it commands a good price.

GENERAL DISTRIBUTION: S. Africa, Coast, Central, Kalahari, and Eastern Regions.

vii. EUSTACHYS, F.T.A. 21.

1. **E. petreae**, Desv. in Nouv. Bull. Soc. Philom. ii (1810), 189 (*Chloris petreae*, Pilg., F.C. 643).

Damaraland: Grootfontein, *Dinter*, 2343.

GENERAL DISTRIBUTION: S. Africa, Coast, Central, Kalahari, and Eastern Regions. Also in tropical Africa.

viii. ELEUSINE, F.C. 644: F.T.A. 21.

1. **E. indica**, Gaertn. F.C. 645.

Ovamboland: Ondongua, *Barnard*, 65!; Damaraland: Tsumeb, on red loam, *Dinter*, 1706a, 2512; Franzfontein, *Dinter*, 2813; Zwart-water, *Dinter*, 2704; Outjo, *Dinter*, 2523.

A troublesome annual weed of no use in winter.

GENERAL DISTRIBUTION: Coast, Kalahari, and Eastern Regions. Tropics of the Old World, introduced? in the New World.



2. **E. verticillata**, *Roxb.*, Hort. Beng. and Fl. Ind. i, 346, Géront. Trop. Damaraland : Tsumeb, *Dinter*, 2463.

ix. DACTYLOCTENIUM, F.C. 646 ; F.T.A. 21.

1. **D. aegyptiacum**, *Willd.* F.C. 646.

Namaqualand : Gibeon, 1000 m., April, *Range*, 1338. Damara-land : Windhuk, in bed of stream, *Gillman*, 16450 ; Swakop mouth, on granite, *Dinter* ; between Okahandja and Osona, near river, *Dinter*, 322. Ovamboland : Ondongua, *Rautanen*, 589.

Good fodder. Widely spread throughout the tropical and sub-tropical regions.

GENERAL DISTRIBUTION : Coast, Kalahari, Eastern Regions.

Var. **mucronatum**, *Schweinf.* in Bull. Herb. Boiss, II (1894), App. 2, p. 34.

Ovamboland : Olukonda, *Schinz*, 662 ; in courtyard, Mission Church in Olukonda, *Schinz*, 621 (an extraordinarily luxuriant growth). The type is cosmopolitan, and is chiefly found in warm countries ; the variety, acc. to Schweinfurth, Beccari, etc., is quoted from Abyssinia and Erythraea. Schinz knows it from Cape Colony, Transvaal, Natal, and Port. E. Africa.

x. TRIRAPHIS, F.C. 650 ; F.T.A. 22.

1. **T. ramosissima**, *Hack.* F.C. 651.

Ovamboland : Cunene banks on stony ground, *Barnard*, 66 ! Namaqualand : Satansplatz, *Dinter*, 2019 ! ; Klipdams River, 1200 m., July, on quartz, *Range*, 397 ! ; Kuibis, 1350 m., May, quartz, *Range*, 670 ! ; Bethany District, Kunab, Fish River, sandstone, April, *Range*, 1003 ! ; near Gibeon, 1200 m., *Range*, 1416 ! 1418 ! ; Ganus Vlei, 1000 m., May, *Range*, 1441 ! ; Maltahöhe District, 1000 m., June, *Range*, 1816 ! Western Karasberg, lateral ravine, about 100 ft. above Wasserfall Alt., *Pearson*, 8492 ! ; Kalkfontein, *Pearson*, 4566 ; Buchholtzbrunn, *Pearson*, 3647 !

**T. Elliotti**, *Rendle*. F.C. 652.

Namaqualand : Keetmanshoop, *Fenchel*, 2.

GENERAL DISTRIBUTION : Little Namaqualand.

2. **T. Fleckii**, *Hack.* F.C. 652.

Ovamboland : Tamansu, *Barnard*, 68 ! ; Amtenya-Katiti, *Barnard*, 67 ! Namaqualand : Schakalskuppe, sandy places, *Range*, 253 ! ; near Gibeon, *Range*, 1437 ! ; Lüderitzbucht, sandy places near Jackals-

kop, *Range*, 1778 !; Seeheim (*Dinter*), Enguruwau, *Dinter*, 3267 !; Holoog, on bank of Great Fish River, *Pearson*, 9813; Haikamchab, *Galpin* and *Pearson*, 7431. Damaraland: Welwitsch, *Galpin* and *Pearson*, 7141; *Pearson*, 4803; Okakueyo, *Dinter*, 3332 !

GENERAL DISTRIBUTION: Kalahari Region and Angola.

3. **T. purpurea**, *Hack.* F.C. 653.

Namaqualand: Araseb flats S. of Aus, *Schenck*, 281; Gubub, near Aus (*Pohle*).

**T. Schinzii**, *Hack.* in Verh. Bot. Ver. Prov. Brand. xxx (1888), 147.

Damaraland: Omatope, *Schinz*, 627; in Omaheke of Otjitjikaberg, *Dinter*, 2549 !; Waterberg, *Dinter*, 1792 !; characteristic grass of Omaheke formation of Grootfontein, Auns, etc. (*Dinter*).

4. **T. membranacea**, *Hack.* in Verh. Bot. Ver. Prov. Brand. xxx (1888), 148.

Ovamboland: Olukonda (*Schinz*).

xi. TRIPOGON, F.T.A. 22.

1. **T. abyssinicus**, *Nees* ex Steud Syn. Pl. Gram. 301.

Ovamboland: Cunene Great Falls, rock crevices, *Barnard*, 69 !; Damaraland: Tsumeb, *Dinter*, 2488 !

PAPPOPHOREAE.

i. ENNEAPOGON, F.C. 654; F.T.A. 22.

1. **E. brachystachyus**, *Stapf.* F.C. 654.

Namaqualand: Cubab, 1000 m., Oct., *Range*, 87 !; Kamms, April, *Range*, 266 !; Kuibis, 1400 m., May, on quartz rocks, *Range*, 648 ! 869 !; Bethany District, Kunab on black sand, *Range*, 1008 !; Kainuchas, near Gibeon, 1200 m., *Range*, 1402 !; near Gibeon, 1250 m., *Range*, 1420 !; Kalahari Kalk, near Elephant River, 1200 m., *Range*, 1435 !; crack in granite hill S. of Tschau Station, *Pearson*, 4261. Damaraland; Welwitsch, *Pearson* and *Galpin*, 7421; Okahandja, along railway embankment (*Dinter*); Welwitsch, *Dinter*, 2812 !

Very good sheep browsing; acc. to *Dinter*, grows in small cushions about 5 cms. high at Nomtsas.

GENERAL DISTRIBUTION: Orange Free State, Griqualand West, Cape Verdes, Senegambia, and from North Africa to North-West India.

2. **E. filifolium**, *Stapf*. M.S. (*Pappophorum filifolium*, Pilg. in Engl. Jahrb. 51, p. 419).

Damaraland : Otjitjika, 35 km. from Grootfontein, *Engler*, 6347.

3. **E. mollis**, *Lehm.* F.C. 655.

Ovamboland : Cunene banks, *Barnard*, 71 ; Namakunde, *Barnard*, 72 ! ; Mafa, *Barnard*, 73 ! ; grass veld round Andoni, *Barnard*, 16520. Namaqualand : Kuibis, quartz rocks, Feb., *Range*, 858 ! ; Schakalskuppe, quartz rocks, *Range*, 877 ! ; Kamms, 1450 m., river-side, *Range*, 901a ! ; Kunab, 1300 m., April, *Range*, 1016 ! 1021a, 1021b ! ; near Gibeon River side, 1245 m., *Range*, 1352 ! 1397 ! Damaraland : Windhuk, in beds of streams, *Gillman*, 16455 ! Hereroland : Nels, 78 ; Okahandja, *Dinter*, 337 !

Useful as fodder for all animals.

GENERAL DISTRIBUTION : Central Kalahari Regions, Eastern tropical Africa, tropical Arabia, and the Punjab.

4. **E. scaber**, *Lehm.* F.C. 656.

Namaqualand : Garuberg, 1200 m., Oct., *Range*, 539 ; Kuibis quartzite, 1350 m., Feb., *Range*, 862, 868 ; near Lüderitzbucht, on granite rocks, 800 m., *Range*, 1068, 1193 ; near Gibeon, 1200 m., April, *Range*, 1407 ; Maltahöhe District, 1100 m., *Range*, 1817. Eastern Karasberg : Narudas Süd, *Pearson*, 8519, 8514 ; Little Karas Mts., western foothills near Holoog, *Pearson*, 9716 ; sand near base of kopje between Dabaigabis and Grundoon, *Pearson*, 3162, 4402, 4559 ; in partial shade, Grundoon, *Pearson*, 3140 ; crevices in limestone on hilltops at Buchholzbrunn, 3500 ft., *Pearson*, 3672 ! ; Seeheim, sandy river bed, *Pearson*, 3722 ; near Dabaigabis, *Pearson*, 4384 ; among dolerite boulders on hill near Gobas Station, *Pearson*, 3717 ; crevices in sandstone, banks of river at Sandverhaar, *Pearson*, 4647, 4632, 4607 ; Raman's Drift, common in dry river course, *Pearson*, 4006 ; Leber River, *Dinter*, 2050 ! Damaraland : Welwitsch, *Dinter*, 2808 !

Found in sandy places, and is useful as fodder for all animals.

GENERAL DISTRIBUTION : Cape Colony, Algiers, Morocco, Bechuana-land.

## ii. SCHMIDTIA, F.C. 657 ; F.T.A. 22.

1. **S. bulbosa**, *Stapf*. F.C. 658.

Namaqualand : S. of Ammin, 1250 m., in sandy places, *Range*, 772 ! ; Western and Central Karasberg, broad, dry, sandy watercourse between Krai Kluft and Wasserfall Alt plateau, *Pearson*, 8515 ! ; Awas Mts. in pass between Haris and Aub, *Pearson*, 9659, 9699 ;

between Hoffnungsfelde and Haris on plateau, *Pearson*, 9544!; Holoog, in bed in Great Fish River, *Pearson*, 9701; Grunddoorn, *Pearson*, 4560! Damaraland: Tsumeb (*Dinter*)!; between Gobabis and Sandfontein, *Gillman*, 16454!; *Bleek*, 16477!; Nuragas, *Lightfoot*, 16531!; Okakueyo, *Dinter*, 1615!; Hyphaenewald (*Dinter*)!

GENERAL DISTRIBUTION: Kalahari Region.

2. **S. pappophoroides**, *Steud* in Schmidt Beitr. Fl. Cap. Verd. Ins. (1852), p. 144.

Ovamboland: Onolongo, *Barnard*, 74!; Namakunde, *Barnard*, 75!; Mafa, *Barnard*, 76! Damaraland: Farm Gras, Nord Anias, Otjitambi, acc. to *Heering* and *Grimme*; Osona, *Dinter*, 123!; Omaheke in Buschfeld, *Dinter*, 2316!

Good fodder.

## PHALARIDEAE.

### i. EHRHARTA, F.C. 660; F.T.A. 23.

1. **E. delicatula**, *Stapf*. F.C. 672.

Namaqualand: Obib, on granite, 550 m., Aug., *Range*, 572; Garies, *Pearson*, 6474; Klinghardtgebirge, *Dinter*, 3928!

GENERAL DISTRIBUTION: Little Namaqualand and Coast Region.

2. **E. longifolia**, *Schrad.* F.C. 667.

Var. **ligulis membranaceis**, *Bol. f.*

Namaqualand: Western Karasberg, sandy river bed above Wasserfall Alt Ravine, *Pearson*, 8475!

3. **E. pusilla**, *Nees*. F.C. 674.

Namaqualand: Klinghardtgebirge, *Dinter*, 3862!

GENERAL DISTRIBUTION: Central Region and Little Namaqualand.

## FESTUCEAE.

### i. FINGERHUTHIA, F.C. 690; F.T.A. 23.

1. **F. africana**, *Lehm.* F.C. 691.

Damaraland: Namutoni to Otjikoto, *Barnard*, 16521!; Tsumeb. *Dinter*, 1698!; Otavifontein, acc. to *Heering* and *Grimme*! Namaqualand: Schakalskuppe, *Pearson*, 4798; *Range*, 86, A. 33, 883!; Eastern Karasberg, lower foothills, Narudas Süd, *Pearson*, 8173!; Awas Mts., *Dinter*, 1901!; pass between Haris and Aub, *Pearson*, 9672!; Klein Karas, *Dinter*, 3216!; in Aristida-steppe,

near Quartel, *Dinter*, 2173; Lüderitz, 71; Orab-Mariental, *Dinter*, 2018!

GENERAL DISTRIBUTION: South Africa, Coast, Central, Kalahari Regions. Also in tropical Transvaal and on the Afghan-Indian frontier.

## ii. ELYTROPHORUS, F.T.A. 23.

1. **E. articulatus**, *Beauv.* Agrost. 67, t. 14.

Damaraland: Okasise (S. Otavi), *Dinter*, 605.

2. **E. globularis**, *Hack.* Bull. Herb. Boiss. ii, ser. II, 935.

Ovamboland: Olukonda (*Rautanen*); Ukualonkathi, edge of vlei, *Barnard*, 79! Damaraland: Okakueyo, *Dinter*, 1570!

## iii. ENTOPLOCAMIA, F.C. 710; F.T.A. 24.

1. **E. aristulata**, *Stapf.* F.C. 711.

Namaqualand: Reheboth, *Fleck*, 803; Orab, on borders of Fish River (*Dinter*); between Narib and Marienthal, in numerous small inlets of Karroo slate, *Dinter*, 2984!; near Nomtsas, *Dinter*, 2014!; Kuija, 1400 m., sandy places, *Range*, 310!; Bethany District, 1300 m., black sand, *Range*, 1009!; Kunab, 1300 m., April, *Range*, 1023!; *Pearson*, 4748!; Farm Gras, Damib, acc. to *Heering* and *Grimme*; Veldschoenhorn, *Dinter*, i, 1098.

GENERAL DISTRIBUTION: Cape Colony.

## iv. SCHISMUS, F.C. 692.

1. **S. fasciculatus**, *Beauv.* F.C. 693.

Var. *tenuis*, *Stapf.*

Namaqualand: Kubib, *Range*, A. 36-89; *Fleck*, 287a, no locality.

GENERAL DISTRIBUTION: Cape Colony, North Africa, Canary Isles, Central Europe, Western Asia.

2. **S. calycinus** (*Loefl.*), *Coss.* in *Coss. et Durand Expl. scient.*

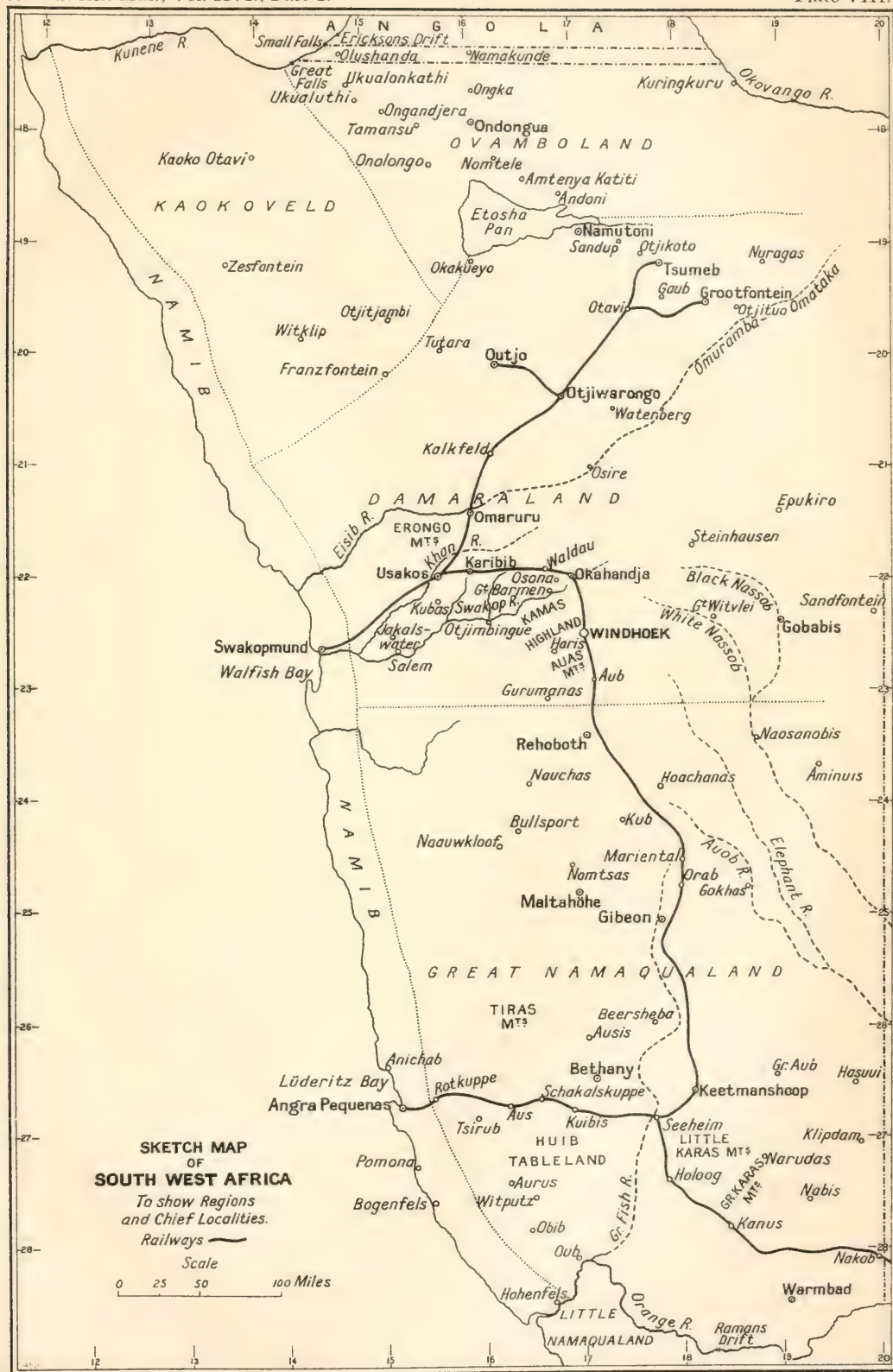
Namaqualand: Inachab, in sand, *Dinter*, 1107.

## v. BROMUS

1. **B. unioides**, *H. B. Kth.* F.C. 734.

Namaqualand: Bethany District, introduced in garden in Kuibis, *Range*, 1197.











3. *Observations on the Genus Volvox in Africa*.—By FLORENCE RICH, Botanical Department, East London College, University of London, and MARY AGARD POCKOCK, Botanical Department, University of Cape Town.

(With Plates IX–XXIV and 6 Text-figures.)

# CONTENTS.

	PAGE
Introduction . . . . .	427
A. <i>Volvox aureus</i> Ehrenb. . . . .	439
1. From Potchefstroom.	
2. From Weltevreden West.	
3. From N'gamo and Old N'gamo, and from the Linyanti River.	
B. <i>Volvox africanus</i> G. S. West . . . . .	440
From the Linyanti River	
C. <i>Volvox capensis</i> sp. nov. . . . .	441
1. From the Cape Flats.	
<i>Forma rhodesiensis</i> f. nov.	
(a) From N'gamo and Old N'gamo.	
(b) From the Linyanti River.	
D. <i>Volvox Rousseletii</i> G. S. West . . . . .	450
1. From the Ussangu Desert.	
2. From Egypt.	
3. From Rietfontein, Transvaal.	
4. From Eliazar Pan and Brakpan, Transvaal.	
5. From Sedudu, Bechuanaland.	
6. From Grahamstown.	
<i>Forma nov. kaokoensis</i> from Kamanyab, Kaokoveld.	
E. <i>Volvox amboensis</i> sp. nov. . . . .	462
From Ongka, Ovamboland.	
Summary . . . . .	465
Conclusion . . . . .	467
Explanation of Plates . . . . .	468

# INTRODUCTION.

AT the time when, in 1905, Mr. C. F. Rousselet stepped from one of the trains conveying members of the British Association across Rhodesia and collected *Volvox* from a pool by the side of the railway-line, very little was known about the occurrence of this genus on the



continent of Africa. *Volvox aureus* Ehrenb. had been noticed by Schmidle\* in material collected in 1899 near the mouth of the Mbasu River, but other records were very scanty. Mr. Rousselet's sample was submitted to the late Professor West† for investigation, and, though no sexual organs were present, the characters of the vegetative colonies were considered by him amply sufficient to warrant the establishment of a new species to which he gave the name *Volvox Rousseletii*. A few years after this, some plankton material collected by Dr. Jakubski of Lemberg (Lwow) from small, temporary pools in the Ussangu Desert‡ was found to contain sexual colonies which West stated to belong to this same species, and from an examination of these he was able to complete the diagnosis.§

In 1907 a curious form of *Volvox* was obtained by Mr. R. T. Leiper from the Albert Nyanza; this was at first described by Professor West|| as "*Volvox aureus* Ehrenb. (a form)," but he subsequently observed characters scarcely in keeping with those of *V. aureus*, and decided to regard it as a "new species or new race" of *Volvox* for which he suggested the name *V. africanus*.¶ It is noteworthy that no trace of this particular *Volvox* had been seen in the other large lakes of Central Africa, even though they had been more thoroughly investigated than the Albert Nyanza. (It was present, associated with *V. Rousseletii*, in the material examined by West from the Ussangu Desert.) In 1914, amongst some freshwater algae from Madagascar, Professor F. E. Fritsch\*\* found a form of *V. aureus* which he styled forma *madagascariensis*, and in the same year Brunthaler†† recorded *V. aureus* from Egypt. The latter species, under the name of *Volvox minor* Stein, was also recorded by Madame Gauthier-Lièvre‡‡ from Algeria in 1925. There was no reason why such a commonly occurring genus should not have further representatives in Africa, yet, as far as we can ascertain, there are no records of

\* Schmidle, W., "Algen, insbesondere solche des Plankton, aus dem Nyassa-See und seiner Umgebung," Engler's Bot. Jahrb., vol. xxxii, 1902, p. 77.

† West, G. S., Journ. Quek. Micr. Club, vol. xi, ser. 2, 1910, pp. 99-104.

‡ In what was formerly German East Africa, and is now Tanganyika.

§ West, G. S., Journ. Quek. Micr. Club, vol. xiii, 1918, pp. 425-428.

|| West, G. S., Journ. Bot., vol. xlvii, 1909, p. 245.

¶ West, G. S., Journ. Quek. Micr. Club, November 1910, pp. 102-103.

\*\* Fritsch, F. E., Ann. de Biologie lacustre, vol. vii, 1914.

†† Brunthaler, J., Beitr. z. Süßwasseralgenflora von Ägypten. Hedwigia, vol. liv, p. 219.

‡‡ Gauthier-Lièvre, "Quelques observations sur la flore algale de l'Algérie dans ses rapports avec le pH," 1925, C. R. Ac. Sc., vol. clxxxi, p. 927.

any (De Toni in his *Sylloge Algarum*, 1889, gives no references); there are certainly none in the collections examined by the following:—

- RABENHORST, L., Beitr. z. Kryptogamenfl. Südafrik., Pilze u. Algen, Allg. deutsch. naturh. Zeit., vol. i, 1855.
- REINSCH, P., "Contr. ad fl. Alg. aq. dulc. Promont. Bon Spei," Journ. Linn. Soc., Bot., vol. xvi, 1877.
- NORDSTEDT, O., Lunds Univ. Arsskrift, vol. xvi, 1880, "De Algis et Characeis I" (Senegal).
- WILLE, N., "Über einige von J. Menyhardt in Südafrika gesammelte Süßwasseralgen," Oesterr. Bot. Zeitschr., 1903.
- WEST, W. and G. S., "Algae from Central Africa," 1896, Journ. Bot., vol. xxxiv.
- OSTENFELD, C. H., "Phytoplankton aus dem Victoria Nyanza," 1908, Engl. Bot. Jahrb., Bd. 41.
- WEST, G. S., Ann. S. Afr. Mus., vol. ix, 1912 (South-West Africa).
- FRITSCH, F. E., Ann. S. Afr. Mus., vol. ix, pt. 7, 1917 (mostly from the Cape Peninsula).
- FRITSCH, F. E., and STEPHENS, E., Trans. Roy. Soc. S. Afr., vol. ix, pt. 1, 1921 (the Transkei Territories).
- FRITSCH, F. E., and RICH, F., Trans. Roy. Soc. S. Afr., vol. xi, pt. 4, 1924 (Natal).
- HODGETTS, W. J., Trans. Roy. Soc. S. Afr., vol. xiii, pt. 1, 1925 (Stellenbosch).
- FRITSCH, F. E., and RICH, F., Trans. Roy. Soc. S. Afr., vol. xviii, pt. 1, 1929 (Griqualand West).
- HUBER-PESTALOZZI, G., Verh. Internat. Ver. Limnol., vol. iv, 1929 (South African plankton).

It was therefore of special interest when the present authors had the opportunity of examining *Volvox* material collected in 1926 from pools on the Cape Flats \* by one of themselves and Miss E. L. Stephens (of the University of Cape Town), and also some from Ovamboland collected by Dr. K. H. Barnard and Dr. R. F. Lawrence (of the South African Museum). Two years later, that is, in 1928, Mrs. G. E. Hutchinson, who with her husband was engaged in making a survey of the planktonic fauna of South African vleis and pans, found *Volvox* in the Transvaal in five different pieces of water, namely, at Rietfontein, Brakpan, Leeuwkraal, Weltevreden West, and Potchefstroom

\* We find that Mr. Steer, Miss Stephens, and others had collected *Volvox* regularly from the Cape Flats and Lakeside since about 1916, and that Dr. Barnard had already found some in Ovamboland in 1923.

(Eliazer Pan). In July 1930 one of us and Miss Stephens collected *Volvox* from a large vlei at Old N'gamo, from pools at N'gamo, from quiet backwaters of the Linyanti (Chobe) River, and from pans and vleis left on the south side of this river from the previous wet season.

All these localities, with the exception of the Linyanti backwaters, are temporary pools \* (usually known locally as vleis), the majority of them grass-bottomed, *i.e.* forming grassy meadowland when they dry up in summer. They occur on soil which is more or less alluvial in character, consisting usually of a mixture of sand and alluvium.

The paper that follows deals with the results of an investigation of the foregoing samples, together with one from Egypt collected by Mr. Douglas Simpson in 1924. It is apparent that *Volvox* flourishes abundantly in Africa, and its absence from earlier collections is a little difficult to understand.

We, like many of our predecessors, realise that considerable variations may occur in one and the same species, not only in the number of constituent cells, in the nature of these cells, in the number of daughter colonies, and in sexuality, but also in the structure of the oospore. There is some doubt as to what should be considered diagnostic features, and there is also some uncertainty as to the number of species of *Volvox*. The structure of the coenobium has been fully described only in the three European species *V. aureus* Ehrenberg, *V. globator* (Linné) Ehrenberg, and *V. tertius* A. Meyer. The two former are the commonest and best known, and differ from one another as follows:—

1. The coenobia of *V. aureus* are usually smaller than those of *V. globator* (the latter measure generally 600 to 800  $\mu$ ).
2. In *V. aureus* the number of constituent cells is from 200 to 4400; in *V. globator* from 1000 to 15,000.
3. The number of daughter colonies in the asexual coenobia varies from 4 to 14 in *V. aureus*; in *V. globator* the number is usually 8 (though it may be more or less).
4. The protoplasts of the cells of the daughter colonies are separated

\* This is contrary to the experience of Professor Iyengar of Madras, who says that in Southern India *Volvox* has never been collected from temporary rain-water pools (he adds that the trampling of animals tends to make the water of these pools very muddy), but it agrees with the description given by J. H. Powers ("Further Studies in *Volvox*," Trans. Amer. Micr. Soc., vol. xxviii, 1908, p. 141) of the occurrence of *Volvox* in parts of America (particularly Nebraska), where *Volvox* was collected mostly from small rain-pools of scarcely a fortnight's duration, while ponds 1 to 2 ft. deep yielded no *Volvox*. The forms of *Volvox* collected in Nebraska are very like the South African representatives.

from one another in *V. aureus* before escape ; in *V. globator* they are still in contact at this stage.

5. The diameter of the daughter colonies on escape is from 200 to 250  $\mu$  in *V. aureus* ; 150 to 200  $\mu$  (rarely to 320  $\mu$ ) in *V. globator*.

6. The protoplasts of the somatic cells in *V. aureus* are almost round in surface view, more oval in side view ; in *V. globator* they are smaller, more closely packed, rather angular in surface view, and flattened basally in side view.

7. The protoplasmic processes are very delicate in *V. aureus* ; in *V. globator* they are thicker, and continuous with processes from the angles of the protoplasts (the chloroplasts extend into these processes).

8. The sexual colonies in *V. aureus* may be exclusively male or female, *i.e.* dioecious, or they may be monoecious, and may or may not contain daughter colonies as well ; in *V. globator* they are almost invariably monoecious (*i.e.* they contain both antheridia and oogonia), and do not, as a rule, contain daughters.

9. The antheridia in *V. aureus* are numerous (as many as two-thirds of all the cells may form sperm bundles) ; in *V. globator* there are only from about 5 (or fewer) to 15.

10. The sperm bundles measure from 12 to 18  $\mu$  in diameter in *V. aureus*, from 23 to 34  $\mu$  in *V. globator*.

11. Each sperm bundle is composed of 16 or 32 spermatozooids in *V. aureus*, from 64 to 256 or more in *V. globator*.

12. The spermatozooids in *V. aureus* have a spherical nucleus and terminal cilia ; in *V. globator* they are more slender, with an elongated nucleus, and the cilia may be either laterally or terminally attached.

13. The oospores in *V. aureus* number from 1 to 15 (usually 3 to 8) ; in *V. globator* they number from 12 to 69 (usually about 30).

14. The oospore in *V. aureus* measures from 60 to 75  $\mu$  in diameter, and its outer wall is smooth ; in *V. globator* it measures from 44 to 56  $\mu$ , and its outer membrane, when ripe, is covered with conical spines.

15. A still more fundamental difference between the two was demonstrated by Meyer \* during an investigation into the structure of the membrane of the coenobium. In *V. aureus* the somatic protoplast is embedded in a thick gelatinous wedge-shaped mass extending far into the interior of the colony, where the radial walls join a central massive star-shaped body (see fig. 1, A<sub>1</sub>) ; in *V. globator* it is enclosed in a short five- or six-sided gelatinous prism tapering very slightly towards the interior of the coenobium from which it is delimited

\* Meyer, A., " Die Plasmaverbindungen und die Membranen von *Volvox*, etc.," Bot. Zeit., vol. liv, 1896, p. 187.



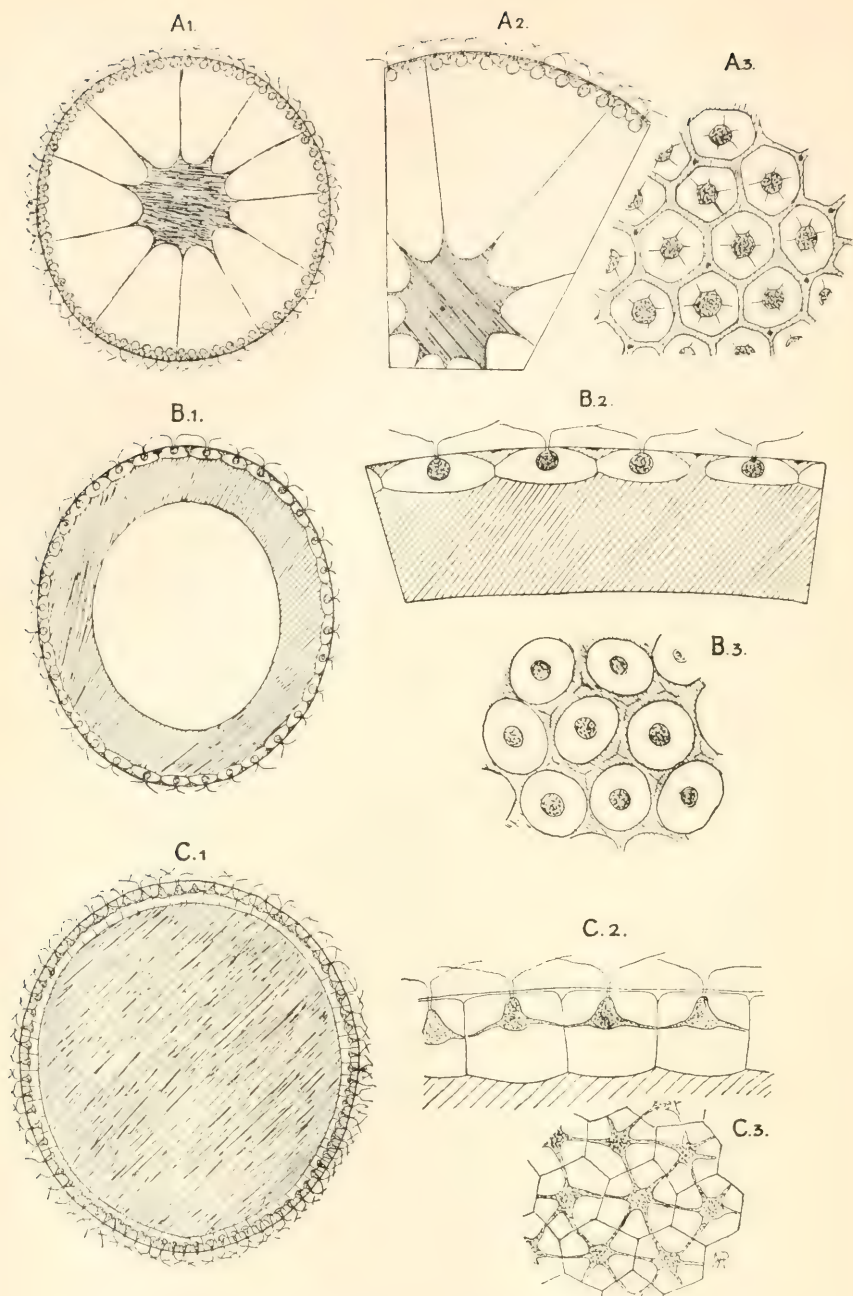


FIG. 1.—*Volvox* membranes, stained with methylene blue.

A, *V. aureus*. B, *V. africanus*. C, *V. capensis* sp. nov. and *V. Rousseletii*.

In each: 1, Optical section of whole colony.  
2, A small portion further enlarged.  
3, Cells in surface view.

In *V. aureus* the central star-shaped mass stains deep purple; in *V. capensis* the mucilaginous content of the hollow sphere stains slightly lighter purple. In *V. africanus* the inner membrane is regular and clearly defined when the colony is young, later becomes displaced and distorted by the developing daughter colonies.  $A_1, B_1, C_1 \times 60$ ;  $A_2 \times 100$ ; others  $\times 500$  (roughly).



by a flat wall, and the cavity of the coenobium within the layer of cells is occupied, according to Meyer, by a watery fluid. It will thus be seen that the differences between these two are greater than is usually the case between two species of the same genus, and it is not surprising that the suggestion has been made that they should be separated. In 1922 Shaw \* placed *V. aureus* in a new genus which he named *Janetosphaera*, retaining *V. globator* in the genus *Volvox*, while he placed *V. tertius*, in which there are no protoplasmic connections between the protoplasts, in another distinct genus *Merrillosphaera*.

Of these, *Volvox* is represented in Africa by several species, of which *V. Rousseletii* is widespread; the present paper describes further species and forms belonging to this section. *Janetosphaera* is represented by *J. aurea* (= *V. aureus*), differing in no marked degree from that found in Europe, while *V. africanus* belongs to the third section (= *Merrillosphaera africana*, according to Shaw).

None of the recently published comprehensive accounts, however, has adopted Shaw's nomenclature, hence the present writers are not using it. All who have worked at the group agree that a revision is necessary, cf. Pascher † and Printz.‡ The latter divides the genus *Volvox* into subsections, to which he applies Shaw's generic names.

G. S. West considered that *V. africanus* was the African species comparable with the European *V. aureus*, and that *V. Rousseletii* was similarly comparable with *V. globator*. The present authors feel that the resemblance between the two latter is greater than that between *V. africanus* and *V. aureus*. Moreover, *V. aureus* itself occurs extensively in Africa. *V. africanus* is more nearly comparable with the European species *V. tertius* Meyer, its membranes being similarly constructed to those of the latter (see text-fig. 1, B). The features on which West § based his two African species may be usefully enumerated here as follows:—

*Volvox africanus* :

1. The coenobia, though approximately the same size as those of *V. aureus*, are of a different shape, being constantly ovoid or egg-shaped.
2. The constituent cells number from 3000 to 8000.
3. The daughter colonies vary in number from 1 to 4 (3 is a common number).

\* Shaw, W. R., The Philippine Journ. of Sci., vol. xx, 1922, p. 478.

† Pascher in Die Süßwasserflora Deutschlands, Österreichs und der Schweiz, vol. iv, 1927, p. 462.

‡ Printz, Volvocaceae in Engler's Nat. Pfl. fam. Ed. II, vol. iii, 1927, p. 59.

§ West, G. S., *op. cit.*, 1918, p. 426.

4. They grow until they almost fill the internal cavity of the parent, becoming flattened by compression; they themselves show well-developed daughter colonies long before their escape from the mother colony, and even a fourth generation is not uncommon.

5. The somatic protoplasts are almost globose, with long, delicate protoplasmic strands (Shaw,\* however, disputes the presence of these strands, and in his earlier account West † states that no protoplasmic connections could be observed).

6. The number of oospores averages 74 (70 to 80); wall of oospore thick and smooth.

The diagnosis of this species was amplified by Shaw from material collected near Manila in July 1914 and subsequently. He found no protoplasmic connections between the cells; in his material there were sometimes as many as 6 or 8 daughter colonies, the oospores varied from 12 to 43 per coenobium, measuring 43 to 45  $\mu$  when ripe. The oospores were sometimes associated with from 2 to 6 sperm plates, but more usually the latter were found in colonies producing no other reproductive cells (100 to 400 per coenobium). He was not able to count the number of sperms—evidently most of his antheridia were still young—but thought it was either 64 or 128 per platelet; he gives the dimensions of one antheridium in the 32-celled stage (26  $\mu$ ) and of one mature sperm plate (7  $\mu$  thick by 20  $\mu$  wide). The antheridium mother-cell often reached 19  $\mu$  before dividing to form a platelet or hollow cup of sperms. According to West this African species differs from *V. aureus* in the ovoid-ellipsoid shape of its asexual colonies, in the larger number of constituent cells, and in the nature of the daughter colonies.

*Volvox Rousseletii* is described by West as follows:—

1. The asexual coenobia are large, having a diameter of from 1125 to 1240  $\mu$  when fully mature.

2. The number of constituent cells is large, 25,000 to 50,000, and they are rather closely aggregated.

3. The somatic protoplasts are somewhat angular, with relatively broad connecting strands.

4. Daughter colonies regularly 8.

5. The sexual colonies are dioecious.

6. Sperm bundles are numerous.

\* Shaw, W. R., *loc. cit.*, vol. xxi, 1922, p. 118; vol. xxii, 1923, pp. 189 and 197.

† West, G. S., *loc. cit.*, 1910, p. 103.

7. The ripe oospores number from 120 to 150 ; they show a decided concentration towards one pole of the coenobium.

8. The wall of the oospore is clothed with strong conical spines ; average diameter without spines  $44\ \mu$ , length of spines 11 to  $12\ \mu$ .

The foregoing description of *V. Rousseletii* is somewhat incomplete ; for instance, the sperm bundles, though shown in the microphotographs published by West, are not described by him.

West considered that *V. Rousseletii* differed from *V. globator* in its larger colonies and the much greater number and closer aggregation of the constituent cells, in the sperm bundles being far more numerous, and the oospores about four times as numerous and showing a concentration towards one pole ; \* he also adds that the long conical spines on the oospore "are very different in appearance from the depressed conical warts on the oospores of *V. globator*." † The question arises as to how far the peculiarities just enumerated are to be looked upon as of specific importance, and whether they may not, after all, be due to differences in nutrition, insolation, temperature, and so on, but it is not the purpose of the present writers to discuss these points here.

We could not help feeling some doubt as to whether the sexual colonies obtained from the Ussangu Desert did really belong to the same species as the asexual colonies collected in Southern Rhodesia, and we considered that if living material could be obtained from the

\* The present authors, however, find a concentration of the oospores towards one end in all the coenobia of *V. globator* that they have been able to examine.

† Surely this is a rather misleading description of the oospores of *V. globator*. It is possible that more than one race has been ascribed to this species, but in the figures given by Janet (*Le Volvox*, Deuxième Mémoire, 1922, pl. iii, fig. 25, and Troisième Mémoire, 1923, pl. xx, fig. 4) the spines are shown as bluntly pointed cones, neither depressed nor wart-like. Shaw, in his key to the species of *Volvox* (*loc. cit.*, May 1922, p. 503), describes the wall of the oospore as "angularly wavy" ; yet in another place (p. 486) he speaks of the oospore as having "a stellate prickly outer membrane"—two descriptions which are not in accord with one another. It is possible that observations may have been made on immature specimens, for all spiny oospores show a wavy outline before the spines are fully grown (see fig. 4, C and D). Klein (*Vergleichende Untersuchungen über Morph. u. Biol. der Fortpfl. bei der Gattung Volvox*, Ber. d. deutsch. Naturf. Ges. zu Freiburg i. B., 1890, p. 84) described the exine of the oospore as spiny (stachelartig). In material from Baden-Baden kindly sent us by Mr. Scourfield are colonies containing 12 to 16 ripe and nearly ripe oospores ; these have a well-developed spiny exine, the conical spines are from 5 to  $8\ \mu$  long, the oospores, including spines, having a diameter of 49 to  $55\ \mu$ .

identical pool in which Mr. Rousselet originally found it, very satisfactory further information concerning it might be obtained. Consequently an attempt was made by Miss E. L. Stephens in 1927 to locate the spot indicated by Rousselet in his paper to the Royal Microscopical Society in 1906,\* and as a result of her inquiries she came to the conclusion that Rousselet had made his collection at Old N'gamo, 5 miles north of the present N'gamo station and 23 miles north of Gwaai. She visited the vleï, which is an extensive one several acres in area in the wet season, with the railway on an embankment built across it, and collected *Volvox*. An accident unfortunately happened to the material and all the *Volvox* perished before it could be examined. In July 1930, however, Miss Stephens and one of us were able to revisit the vleï and we found *Volvox* swarming in parts of it, chiefly in the deep part alongside the embankment. It was particularly abundant in the partially shaded water in a culvert under the line connecting the two parts of the vleï; this part is probably the last to dry up, and it may have been here that Mr. Rousselet collected. On this occasion the dominant form was *V. aureus*, but another form, very like *V. Rousseletii* but still more like the form found on the Cape Flats, was present as well, in all stages both sexual and asexual.

But subsequently we found another more detailed account by Rousselet,† made several years later, in which he states explicitly that he collected the *Volvox* at Gwaai station: "the train stopped for half an hour at this station by the side of a shallow pool formed by the Gwaai River." Thus his two accounts are contradictory. It has not yet been possible to revisit Gwaai, but we know that there too, for part of the year at any rate, are pools close to the station.‡ Probably no one can now prove which of Rousselet's two accounts is the correct one. If the first account is correct, then Old N'gamo must have been the spot where he collected, and it would appear that the doubt expressed above was justified, for while the material found at

\* Journ. Roy. Micr. Soc., 1906, p. 393. Mr. Rousselet says that he had collected it at "a station beyond Gwaai, where a stream forms a rather shallow pool close to the station." Formerly the Victoria Falls train stopped at Gwaai, and also 23 miles farther north (to take in water) at what is now Old N'gamo. Gwaai at present is an unimportant siding and Old N'gamo not even a halt, while a new station has been made at N'gamo.

† Rousselet, C. F., Journ. Quek. Micr. Club, vol. xii, ser. 2, 1913-1915.

‡ In April 1925 one of us, unconsciously imitating Rousselet, jumped from the train during an all too brief halt at Gwaai and secured several dips from adjacent pools, but unfortunately without finding *Volvox*. It was the end of a



Old N'gamo (and also at N'gamo) possesses asexual colonies like those described by West for Rhodesia, the sexual colonies associated with them are not of the type described from Ussangu and presumed by him to belong to the same species.

In any case, the existence of two distinct types has been established, and we have been fortunate enough to obtain from Rhodesia and other localities sexual and associated asexual colonies of both types—the Ussangu type from Egypt, Rietfontein (Transvaal), and Sedudu (N. Bechuanaland Protectorate), and the Old N'gamo type from the Cape Flats as well as from other parts of Rhodesia and the Bechuanaland Protectorate.

The main point of difference between these two types is that in one the sexual colonies are dioecious, in the other they are monoecious. Now, whereas in *V. globator* the sexual colonies are consistently monoecious, it is well known that in *V. aureus* monoecious as well as the more usual dioecious colonies may occur, and we should hesitate to make this a character of diagnostic importance were it not for (a) its constancy in a particular type, and (b) its association with other slight but well-defined differences.

With regard to (a), cultures of the Rietfontein *Volvox* have been watched constantly for a period of over eighteen months, and the colonies have been found to remain dioecious, with very rare exceptions in which a few antheridia developed in otherwise preponderatingly female coenobia (the reverse—oospores in a male coenobium—was never once seen), while the Cape Flats *Volvox* during some years of observation (which was particularly close and detailed in 1930 and 1931) has been found to be consistently monoecious.\* These two examples, from Rietfontein and from the Cape Flats, are cited in particular, since they are the two whose life-history has been methodically observed, but collections of *Volvox* from elsewhere appear to confirm these observations.

In view of the existence of these two types we propose to create a new species to include the type found at Old N'gamo and on the Cape Flats, and, since it has been fully known longer from the latter locality, to name it *V. capensis*. It will be seen that this species shows several

particularly wet rainy season, and it seems probable that *Volvox* does not develop in that region until later in the season when the water has grown shallower. It is obviously widespread in Rhodesia.

\* The results of these observations are embodied in a paper by M. A. Pocock forming the third of the series on *Volvox* in Africa, and appearing in Part 4 of this volume.



characters in common with *V. globator*, and that it is intermediate between that species and *V. Rousseletii*.

Before proceeding to describe the forms we have found, we think it advisable to enumerate the features on which Shaw laid stress in describing new species and genera from Manila.\* In addition to the recognised significance of dimensions, presence or absence of connecting protoplasmic strands, and variations in the oospore wall, he considered of importance the size attained by the gonidia (the asexual reproductive cells) before dividing, and whether or not they become segmented before the birth of the young coenobia in which they occur. Another point of importance, in his view, is whether all the daughter colonies are born through one opening in the wall of the mother colony, or whether each daughter is born through a separate opening; a study of this in preserved material is, of course, very unsatisfactory. Shaw also laid stress on the migration of the gonidia from the outside to the inside of the developing embryo, but the subsequent or almost simultaneous work of Kuschakewitsch † has shown that on completion of cell-division of the developing gonidium the young coenobium (embryo) undergoes complete inversion, whereby the inner surface comes to lie outside.‡ Shaw further pointed out that it was important to make observations during the night or late afternoon, when he believed many of the changes in the life-history usually occur. We have acted on this hint, but so far our results do not confirm Shaw's opinion—it is possibly correct as regards actual cell-division, but all other stages have been observed during the day as well as at night; in fact, inversion appears to take place more commonly during the day, which perhaps explains how it came about that Shaw during his extensive studies on *Volvox* overlooked this phenomenon.

In the following account we deal with the forms of *Volvox* we have examined from different localities, placing each under the species to which it belongs.

\* Shaw, W. R., *op. cit.*, vol. xv, 1919; vol. xx, 1922; vol. xxi, 1922; vol. xxii, 1923.

† Kuschakewitsch, Bull. Acad. Sc. de l'Oukraine, vol. i, 1922, p. 1.

‡ Both Kuschakewitsch and Zimmermann (Naturwissenschaften, 1925, p. 401) thought that inversion preceded cilia formation. Recent observations of the South African forms, however, show that the cilia are being formed during the process, and that probably the mechanism of inversion is intimately connected with cilia formation.

A. *Volvox aureus* Ehrenb.

Present in Eliazer Pan (Potchefstroom) and Weltevreden West (Ermelo), Transvaal, vleis in the N'gamo district (S. Rhodesia) and along the Linyanti River (N. Bechuanaland Protectorate).

1. From *Potchefstroom*. (Collected from Eliazer Pan, where it is associated with *V. Rousseletii* (Plate IX, fig. A).)

The colonies are spherical or sub-spherical, from about 300 to 500  $\mu$  in diameter, and usually contain one type of reproductive cell only; mixed colonies occur very rarely. The protoplasts of the somatic cells are rounded, with slight indications in surface view of angles where the protoplasmic connecting strands are attached. They measure from 6 to 9  $\mu$  across, and are from 1 to 4 diameters apart; they are rather more closely packed \* at the posterior pole (this is true of all three types of colonies). The protoplasmic connecting strands are very fine and thread-like; they do not preserve well, but usually show fairly clearly when stained with methylene blue.

The number of daughter colonies varies from 4 to 13 (Plate X, fig. A), 8 being a frequent number; the size on escape is not less than 180  $\mu$ ; the gonidia at birth are most often undivided, or else are at an early stage (4- to 8-celled) of division. The sexual colonies are mostly dioecious, rarely monoecious, a little smaller than the asexual. The male coenobia are similar to those figured by Janet (Le *Volvox*, 1912, fig. 15, J); they are shown in the microphotographs (Plate IX, figs. B and D, and Plate XI, fig. A). In all these photographs the male colonies are somewhat young, with a large number of antheridia in various stages of development. They measure about 400 to 450  $\mu$  in diameter. The number of antheridia is very large (in two cases 403 and 605 respectively were counted), scattered thickly over three-quarters of the colony, leaving the anterior quarter free; somatic cells occur among them. The sperm bundles (Plate X, fig. C) are saucer-shaped, measuring from 14 to 20  $\mu$  across, and each is composed of 32 spermatozoids.

The female coenobia (Plate IX, figs. B and C, and Plate X, fig. D) are slightly larger than the male, diameter 450 to 520  $\mu$ , and usually contain about 8 oospores, but the number varies from 4 to 11. The

\* We have noticed closer packing at the posterior pole in English specimens of *V. aureus*, though no reference is made to this in the text-books. Shaw mentions it in connection with *V. aureus* from California (*Op. cit.*, vol. xx, May 1922, p. 484).

oospore measures from 64 to 73  $\mu$  in diameter, with smooth, thick outer wall (Plate X, fig. E). A comparison was made with *V. aureus* forma *madagascariensis* (Professor Fritsch's material), but we find it agrees more closely with the type than with this form.

2. From *Welleveden West* (only asexual colonies were collected).
3. From *N'gamo* and *Old N'gamo* (S. Rhodesia), and from vleis along the *Linyanti River* (Bechuanaland Protectorate), particularly at Kazungula and Kabulabula (Plate XI, figs. B, C).

*V. aureus* is evidently widespread in this region of Africa. The collections were made in July, *i.e.* midwinter, when the vleis left by the rains of the previous wet season (ending March or April) were still extensive. It was usually associated with *V. Rousseletii* and *Pleodorina californica* (Plate XI, fig. B), and a rich phytoplankton of desmids, and other unicellular, colonial, and filamentous algae.

Except for its greater size it is similar to the *V. aureus* found at Potchefstroom, and is characterised by the small degree of differentiation reached by the third generation at the birth of the daughter colonies, and the marked rarity of mixed colonies, the great majority producing either only gonidia, only antheridia, or only oogonia.

The number of cells is usually between 1000 and 3000, the protoplasts are from 6 to 9  $\mu$  in diameter. The greatest size noted for asexual colonies was  $782 \times 816 \mu$ ; female colonies up to  $604 \times 625 \mu$ , and males up to  $539 \times 560 \mu$ , were measured (these measurements were all made free on the slide, not under the pressure of a cover slip). The smallest free colony measured was  $182 \times 194 \mu$ , but daughters *in situ* with a diameter of 243  $\mu$  were seen; the largest number of daughters per coenobium observed was 11.

Platelets, always of 32 spermatozooids, measured 20  $\mu$ ; oospores (up to 11 per colony) from 65 to 84  $\mu$  in diameter.

B. *Volvox africanus* G. S. West. Plate XII, figs. A, B.

Late in our investigations we found this species in material from a pool near the wagon road leading from Kazungula to Kasani, on the Linyanti River. The pool was long and shallow, about 1 foot deep, and fairly clear. The *Volvox* association was rich—large colonies of *V. capensis* predominated, with *V. aureus*, *V. africanus*, and *Pleodorina californica* mixed with them. The colonies of *V. africanus* were comparatively few, and all asexual; in most, the daughter colonies numbered 4—the 2 larger opposite one another in the

equatorial plane, the 2 smaller near the posterior pole—but the number varied from 1 to 6. In most cases where an unpaired daughter occurred, the other member of the pair was represented by an abortive gonidium. So far as could be seen the daughters themselves were all asexual. The smallest colony seen with mature daughters measured  $345 \times 431 \mu$ , and contained a single well-developed daughter; the largest,  $603 \times 646 \mu$ , with 4 daughters one of which measured  $218 \times 258 \mu$ ; each of these 4 daughters bore 2+2 gonidia in early stages (2- to 4-celled) of division.

This *Volvox* agrees very closely with the description given by West,\* except that no trace whatever of protoplasmic connections between the cells in the adult colonies, or even in young colonies, could be made out. (This is in accord with recent observations made by Professor Iyengar on a small form of *V. africanus* collected in Southern India.† See also Shaw's remarks quoted above.) In unborn daughter colonies, however, after treatment with methylene blue, a connection between the cells is here and there observable; this resembles the state of things described by Meyer for *V. tertius*.‡

#### C. *Volvox capensis* sp. nov.

*Volvox* monoicus; coenobiis sub-globosis vel late ellipsoideis; coenobiis asexualibus majoribus usque ad 1.3 mm. latis, cellulis ca. 9000–23,000, plerumque 18,000–20,000, in parte posteriore densiore aggregatis; coenobiis infantibus 3–20, plerumque 6–10, saepe 8, in planis duobus alternantibus,  $170\text{--}430 \mu$ , plerumque  $200\text{--}300 \mu$  latis; coenobiis sexualibus usque ad 1 mm. latis, bisexualibus protandreis; androgonidiis 4–23, plerumque 6–10, similiter coenobiis infantibus dispositis; spermatozoidis 512 rarissime 256, in globoidis depressis  $40\text{--}44 \mu$  latis; oosporis 60–160, plerumque ca. 120, diametro sine spinis  $37\text{--}49 \mu$ , in parte tertia anteriore coenobii absentibus; spinis cavis conicis usque ad  $5\text{--}8 \mu$  longis obtectis.

This species is intermediate between *V. globator* and *V. Rousseletii*. From the former it is distinguished by (1) greater size; (2) larger number of somatic cells; (3) antheridia more numerous, developing uniformly into depressed hollow globoids of 512 (rarely 256) spermatozooids, never into platelets; (4) much larger number of oospores, averaging 120 per coenobium as compared with 30 in *V. globator*; (5) spines of exine longer and stouter, less numerous as seen in optical

\* West, G. S., *op. cit.*, 1918.

† In the press.

‡ Meyer, Bot. Zeit., vol. liv, p. 200.



section. From the latter it is distinguished by (1) smaller size of coenobia, which are subglobose to broadly ellipsoid instead of ovoid ; (2) slightly smaller number of somatic cells ; (3) sexual colonies always monoecious and protandrous ; (4) antheridia much fewer—at most 23 or 26 as against several hundreds in *V. Rousseletii*—and developing differently ; \* (5) oospores less numerous, as large or larger, but spines usually shorter.

The gonidia are differentiated *before* completion of cell-division, and can be clearly seen in daughter colonies which are about to invert. They remain undivided until after the birth of the daughter colony, but are easily distinguished by their greater size (diameter 11 to 15  $\mu$  as compared with 4 to 5  $\mu$  in the case of the somatic cells). The sexual reproductive cells may also be distinguished before birth, but are smaller than the gonidia (diameter 6 to 8  $\mu$ ).

Under normal conditions the coenobia are markedly globose ; the polar axis in young colonies is a little longer than the equatorial diameter, becoming more so as the colony ages, particularly in the sexual colonies, but less markedly so than in *V. Rousseletii*. Usually the two poles are similar in form (see Plate XII, figs. C, D, and Plate XIII, fig. A), whereas in the latter species the tendency is for one or other pole to become broader (*cf.* Plate XVIII, figs. A–C, Plate XX, fig. F, and text-fig. 2, G). In both species during cold weather the anterior pole sometimes protrudes in a peculiar and characteristic manner (see some of the coenobia in Plate XVIII, fig. D).

In this species we include the *Volvox* occurring in many vleis on the Cape Flats, and which we regard as typical, and that collected in Rhodesia (N'gamo, Old N'gamo) and the Bechuanaland Protectorate (backwaters and vleis of the Linyanti or Chobe River). It was at first thought that the latter formed a distinct variety, but after observing *V. capensis* on the Cape Flats during an unusually late season—November 1931—at temperatures much higher than are usual for *Volvox* in these parts, we had to modify this opinion. The chief features considered characteristic of the Rhodesian form—*i.e.* large size, unusually large number of daughter colonies and of sperm bundles per coenobium—were found appearing, though to a less marked degree, in the Flats *Volvox*, in those vleis which still retained water (*e.g.* Ottery Road, and Belvedere Road Vlei III). The Rhodesian and Bechuanaland material is therefore described merely as a form of *V. capensis* and not as a variety.

\* Pocock, M. A., this volume, Part 4.



1. From the *Cape Flats*.

The "Cape Flats" is the name given to the strip of low-lying land forming the isthmus which joins the Cape Peninsula to the mainland. The greater part is covered by blown sand, but near Table Mountain are fairly extensive stretches of alluvial soil (Plate XXIV, fig. D). During the winter months shallow pools, some of considerable extent, form on the flats, and these yield a rich algal flora. In several of those on the alluvial soil *Volvox* has been found; all dry up very soon after the south-east winds of early summer begin, so that as a rule *Volvox* is found only in winter and spring, only very rarely is it found as late as November, as in 1931.

In October 1927 *Volvox* was collected from two of a series of vleis near Belvedere Road \* (between Keurboom and St. Michael Roads), Claremont, and from Scanlan's Vlei, Wetton Road, a few miles distant; observations were started on the living material, but the supply ran short just when further investigations were desired. The following season (1928) was a particularly good one for *Volvox*, whereas that of 1929 was very unfavourable—the winter rains accompanied by cold weather were late, the late rains were poor, and many vleis did not fill up at all. At first a fair amount of good *Volvox* material (all asexual) was collected, but later on in the season repeated efforts to obtain sexual material were entirely unsuccessful. In one case a promising pool in a ditch near the farm Vaderlandsche Rietvlei yielded on a second visit plenty of coenobia, but in every case they were inhabited by a Rotifer busily eating away daughter colonies and parent cells,† and no sexual colonies were present (Plate XIV, figs. B–D). Other pools previously full of *Volvox* had now scarcely any water in them and consequently no algal growth.

The winter of 1930 was exceptionally dry, particularly on the Cape Flats—one farm on Princess Vlei recorded a total rainfall of only 4 inches for the year (considerably less than the Kalahari)—and in most parts the rain simply soaked into the ground, no pools being formed. The Wetton Road Vlei, however, was an exception to the general rule;

\* Of these, one of the best has since become part of Ackerman's Sports Ground, and is in process of being filled up with rubbish and sand.

† A photograph of this Rotifer has been sent to Mr. C. C. A. Monro, Assistant Keeper in the Department of Zoology, British Museum (Natural History), who has been kind enough to examine it. He says the photograph appears to correspond most nearly to *Ascomorpha volvocicola* Plate. Several species of Rotifer are known to live in *Volvox*. Many individuals and their eggs were often observed inside a single coenobium. Even when half the cells and the daughter colonies had been devoured the colonies were still active and strongly phototactic.

it lies near Wynberg, a part which has more rain than the rest of the district, was fairly full of water and yielded abundant *Volvox* in very good condition. Later in the season the *Volvox* in the main vlei (Scanlan's) was badly attacked by Rotifers, but a ditch nearby contained particularly large and healthy colonies for some time longer.

In 1931 good rains in May, followed by warm sunny weather, resulted in a fine crop of *Volvox*; the *Volvox* supply continued good right through the winter—now in one vlei, then in another—and well into the summer, some of the most interesting observations being made from the Ottery Road Vlei, Wynberg, and Belvedere Road Vlei as late as November. It was found that *Volvox* reached its optimum development in the unusually high temperatures of a week of hot weather in November (water temperature over 90° F.).

The study of this living material has thrown light on several perplexing points, and has enabled the second author of this paper to write on the subject much more extensively.

The coenobium is usually a prolate spheroid, with the polar axis a little longer than the equatorial, but the shape varies considerably, and the equatorial diameter may equal, or sometimes in mature asexual colonies even exceed, the polar axis. As a rule, the sexual colonies are more elongated than the asexual.

The number of cells in mature colonies varies from about 9000 to 23,000, most often lying between 18,000 and 20,000 in a vigorous mature strain. The number drops in colonies produced in cold weather and as the strain ages. The protoplasts are more closely aggregated towards the posterior pole. As seen in side view they are somewhat pear-shaped (Plate XV, figs. A and B). The apices of the cells do not quite reach the outer membrane. When young the protoplasts appear star-shaped in surface view (Plate XIII, fig. B); the angles are drawn out to form relatively thick protoplasmic connections into which the chloroplast extends, so that the whole coenobium appears covered with a green network. This shows up clearly even when the colony is rotating; it is seen most beautifully if the colonies are examined with a fairly low objective against a black background. As the colony matures, the protoplasts become further apart and smaller, and the connecting strands more finely drawn out, so that the star-shaped form is more or less lost; the chloroplasts too are withdrawn from the strands.

There is a single chloroplast filling the base of the cell and extending up one side to the cell apex at the points of insertion of the cilia; in the massive bowl-shaped basal portion is embedded one large pyrenoid.

The two long cilia are inserted separately at opposite corners of the cell apex as in *V. Rousseletii* (see text-fig. 3, A); at the point of insertion of each is a highly refractive granule. The basal quarter of the cilium projects from the enveloping membrane at right angles to the surface, and is rigid and immobile, with the remaining three-quarters lashing vigorously with a rotary motion in a spheroidal plane parallel to the outer wall of the coenobium. In the anterior cells the large lenticular orange-red eyespot or stigma lies in the upward extension of the chloroplast, a little below the apex, and symmetrically between the points of insertion of the cilia always facing towards the anterior pole (Plate XV, fig. A). At the anterior pole it is about  $2\ \mu$  in diameter, becomes smaller towards the equator, and disappears entirely as a pigmented spot in the cells about the posterior pole. In the latter its place is occupied by a highly refractive granule, just as described by Janet\* for *V. globator* and *V. aureus*.

From two to four contractile vacuoles with a periodicity of from 15 to 30 seconds, more or less, occur in the angles of the base of the protoplast near the connecting strands, and probably one or two smaller vacuoles are situated in the colourless throat of the protoplast near the apex; the latter were, however, seldom distinguishable. Occasionally contractile vacuoles may occur in the connecting strands themselves.

The number of daughter colonies early in the life of a strain is usually 8, arranged alternately in two planes (Plate XIII, fig. D). Plate XII, fig. C, shows a group of colonies from a very young strain, collected about a week after rain had fallen and formed a pool in the vlel. It includes several "juveniles," † formed on germination of oospores, each with one or two daughter colonies. The latter may give rise to from 4 to 6 daughters, and the third generation to 8. If conditions are favourable—in particular if the weather be warm—the number of daughters increases; in a vigorous strain there are usually from 9 to 12 daughters, or even more. During the succeeding sexual phase (Plate XII, fig. D) the number may drop, but this is not always the case (Plate XIII, fig. A, and Plate XIV, fig. A). The latter figure shows a group of colonies in which the number of daughters was abnormally high—as many as 20 were seen, while from 15 to 18 were common. This case, from Belvedere Road Vlel No. 3, has already been referred to, and it seems certain that the high number of daughters was directly connected with the unusually high temperature.

\* Janet, C., *Le Volvox*, 1912, p. 48.

† These juvenile forms are described fully in paper No. 3.

The daughter colony rotates for some time within its vesicle (the enlarged gonidium wall), finally escaping outwards through a pore which it bores in the wall of the coenobium. Normally, in a healthy colony each daughter escapes thus through its own pore; the daughter colonies do *not* rotate freely within the hollow of the parent; each vesicle remains intact until broken by the escaping daughters in the region where it forms part of the outer membrane of the colony.

The sexual colonies are usually globose (Plate XIII, fig. C) or broadly ellipsoidal, somewhat smaller than the asexual colonies, monoecious and strongly protandrous, with well-marked polarity, the anterior end always being clear of reproductive cells. Unless the strain is an old one nearing the end of sexual activity it is most unusual to find daughter colonies in a sexual coenobium. The antheridia vary from about 4 to 20 in number, usually from about 6 to 10. As in the case of the gonidia, there appear to be 8 primary antheridia arranged similarly, *i.e.* alternately in two planes. More than 13 were found only in the hot weather form from Belvedere Road. The mature sperm bundle is a depressed hollow globoid of 512 spermatozooids, the central hollow appearing circular in surface view, narrowly elliptical in side view (Plate XV, figs. C and D). The cilia are very long. Like the daughter colony, the sperm globoid usually escapes outwards; occasionally, however, it escapes inwards, and may disintegrate within the hollow of the parent. The spermatozoid is similar to that of *V. Rousseletii* (text-fig. 3, D).

When the sperm globoids are fully developed, the oospheres are still immature; only very rarely are sperm globoids and oospores to be found in the same colony. Gaps in the cell network show where the globoids have developed and escaped (Plate XIII, fig. C).

The oosphere (Plate XII, fig. E) is deep green, very broadly flask-shaped, the broad apex a little below the outer surface of the parent. After fertilisation it rounds off, lying below the level of the inner membrane, enclosed within the delicate vesicle formed from the much enlarged wall of the oogonium, which in its early stages develops similarly to the young antheridium. Within this vesicle the oospore develops. At first it is bounded by a thin wall; the outline becomes irregular, and an outer hyaline wall of spirally arranged conical spines is formed, the green protoplast extending into the spines. When this exospore has been secreted, the green protoplast is withdrawn from the spines, rounds off once more, and the inner wall is laid down (text-fig. 4, C, and Plate XV, fig. F). This again consists of two layers—a thick mesospore and a very delicate endospore bounding the protoplast.



The colour of the protoplast changes from green to orange-red, and the oospore is ready for liberation, which is brought about by the disintegration of the parent. This takes place very soon after the change in colour, so that on the Cape Flats colonies containing ripe oospores are remarkably rare (Plate XIII, fig. E, and Plate XV, fig. E).

Oospores in various stages of development are shown in text-fig. 4, C, 1-3.

Dimensions, etc., of *V. capensis* from the Cape Flats.

Mature asexual colony,  $667 \times 754 \mu$  to  $1250 \times 1292 \mu$ ; average about  $800 \times 850 \mu$ .

Mature sexual colony,  $495 \times 560 \mu$  to  $928 \times 1034 \mu$ ; average about  $625 \times 660 \mu$ .

Mature daughter colony,  $129 \times 139 \mu$  to  $431 \times 495 \mu$ ; average about  $200 \times 230 \mu$ .

Somatic cell: anterior pole 12 to 18  $\mu$ ; posterior pole 11 to 13  $\mu$ .

Somatic protoplast: anterior pole 6 to 11  $\mu$ ; posterior pole 5 to 9  $\mu$ ; average 5 to 7  $\mu$ .

Somatic protoplast in daughter colony before birth, 4 to 5  $\mu$ .

Gonidium protoplast in daughter colony before birth, 11 to 13  $\mu$ .

Sexual cell protoplast in daughter colony before birth, 6 to 7  $\mu$ .

Number of somatic cells, 9000 to 23,000, most often 18,000 to 20,000.

Number of daughter colonies, 4 to 12; in very warm weather up to 20.

Number of sperm globoids, 5 to 13; in very warm weather up to 19.

Number of oospores, 60 to 160; average 120.

Size of sperm globoid, 33 to 44  $\mu$ .

Size of oospore with spines, 49 to 62  $\mu$ ; without spines, 37 to 49  $\mu$ ; spines, 5 to 8  $\mu$ .

## 2. *V. capensis* forma *rhodesiensis* f. nov.

Forma magna, antheridiis numerosioribus, usque ad 35, oosporis majoribus quam in forma typica.

From N'gamo and Old N'gamo in Rhodesia, and from vleis and backwaters of the Linyanti, Bechuanaland Protectorate.\*

(a) From *N'gamo* and *Old N'gamo* (Southern Rhodesia).

Near N'gamo station there are several small vleis from which *Volvox* was collected at the beginning of July 1930. The following day the vlei at Old N'gamo, 5 miles north, was visited; *Volvox* was collected

\* Geographically parts of both Northern and Southern Rhodesia and the Bechuanaland Protectorate are one region. Their boundaries meet on the Linyanti near Kazungula, hence the regional name may appropriately be used for the form. The word N'gamo is probably of Bushman origin, meaning water.



in several parts, but chiefly in the deep channel to the east of the railway embankment. *V. aureus* predominated, but a fair amount of the monoecious *V. capensis* was found. There were indications that the latter species was in an early stage of development, *e.g.* the presence of one or two "juveniles" from recently germinated oospores, and the rarity of colonies with developing or mature oospores.

Both asexual and sexual colonies are globose when young (Plate XVI, fig. A), the polar axis only slightly longer than the equatorial, but the sexual colonies often become considerably elongated during the ripening of the oospores. The asexual colonies resemble those from Rhodesia photographed by West in 1910 (*Op. cit.*, pl. iii, figs. 1-7). The average number of daughters is 8, but the number varies considerably. There is also considerable variation in the size of the protoplasts; often these are similar in size to those of typical adult colonies from the Cape Flats (5 to 7  $\mu$  in diameter), but other colonies of approximately the same age occur in which the protoplasts are considerably larger (8 to 10  $\mu$ ), giving the cell network a very much coarser appearance. A similar variation was observed on the Cape Flats, but there nearly always correlated with either the age of the strain or the individual, or with external conditions. Here and on the Linyanti, however, the various types occur side by side, and it is impossible to say from the preserved material, collected over a total period of only three weeks for the whole district, whether this variation is characteristic of the form as a whole, or whether different forms are actually present.

Plate XVII, fig. A, shows a young sexual colony which was of the large-celled type; 5 or 6 mature sperm bundles and numerous young oospheres are visible; gaps in the cell network indicate positions of sperm bundles which have escaped. Plate XVII, fig. B, shows in more detail a small portion of the cell network with a very young oogonium in the early stage of enlargement. This can be distinguished in fig. A as a larger black cell a little below the centre to the left, next to the oosphere directly above the large gap in the network seen near the posterior pole of the colony. These photographs and Plate XVI, figs. B-E, show what beautiful preservation may be obtained by using Powers' Iodine method of fixation.\* In Plate XVII, fig. B, the star-shaped cells are practically undistorted; the protoplasmic connections are clear, but since they dip down below the point where they unite with the protoplast they appear discontinuous.

The sexual colonies are large in proportion to the asexual, but few

\* See Chamberlain, Methods in Plant Histology, 4th ed., pp. 178-179.

really mature asexual colonies are present in the preserved material, and they probably reach a considerably larger size during the asexual phase. The number of sperm globoids is generally high; from 7 to 20 per coenobium were counted, while 15 to 18 are common. They are composed of 512 spermatozoids, and are similar in structure and appearance to those from the Cape Flats but somewhat smaller (Plate XVI, figs. B and C).

The oospores are large (Plate XVI, fig. E), of the same type as those of the Cape Flats, but the spines are a little longer and more strongly developed (text-fig. 4, D).

Plate XVI, fig. D, shows a nearly mature oosphere which had sperms swarming round the base. The broad apex is sunk slightly below the neighbouring somatic cells, with which it is still in protoplasmic connection; the broader rounded base, enclosed in the vesicle outside which are the sperms, projects into the cavity of the parent colony. The rounded central body is the nucleolus, the rest of the large nucleus being obscured by the massive chloroplast.

Dimensions of *V. capensis* f. *rhodesiensis* from N'gamo and Old N'gamo.

Asexual colonies (immature),  $800 \times 858 \mu$  to  $1034 \times 1142 \mu$ .

Sexual colonies,  $603 \times 624 \mu$  to  $1292 \times 1335 \mu$ .

Daughter colonies,  $345 \times 388 \mu$ .

Somatic protoplasts, 5 to 9  $\mu$ .

Sperm globoid, 30 to 35  $\mu$ ; 7 to 20 in number.

Oospore with spines, 64 to 69  $\mu$ ; without spines, 40 to 46  $\mu$ ; spines, 9 to 13  $\mu$ .

Number of oospores, 50 to 220.

(b) From the *Linyanti River* (Plate XVII, figs. C, D).

On the south bank of the Linyanti or Chobe River, near its junction with the Zambesi River, a number of pans and vleis of varying extent form during the rainy season, while farther west there is extensive swamp-land, also bordered by a series of similar vleis. In most of these pans and vleis, and in many quiet backwaters of the river itself, *Volvox* was found. The district is obviously very rich in *Volvox*, and would probably well repay a prolonged and intensive study of the group on the spot. In the majority of cases *V. aureus* and a form of *V. capensis* were present in varying proportions; in one vlei near Kasani *V. africanus* was found, and in a few cases, e.g. at Sedudu, the dioecious *V. Rousseletii* was also collected. The collections are, however, too limited—usually not more than one from each locality—

to arrive at any clear idea as to the conditions governing the appearance of any one species.

As a whole, the material of *V. capensis* is very like that described above from N'gamo, but there are a few points which may be noticed here. The variation in the size of the protoplasts is even more marked than in the N'gamo material. The number of sperm bundles is greater, as many as 35 having been counted in a single large coenobium. The oospores, on the other hand, although very large, have as a rule relatively shorter spines, and are more like the Flats form than are those from N'gamo; in some localities, however, the longer-spined form also occurs.

Dimensions of *V. capensis* f. *rhodesiensis* from the Linyanti River.

Asexual colonies,  $625 \times 667 \mu$  to  $1323 \times 1357 \mu$ .

Sexual colonies,  $539 \times 646 \mu$  to  $1252 \times 1313 \mu$ .

Daughter colonies,  $322 \times 344 \mu$ ; 5 to 19 in number.

Somatic protoplast, 5 to  $10 \mu$ .

Sperm globoids, 32 to  $38 \mu$ ; (?) 7 to 35 in number.

Oospore with spines, 58 to  $70 \mu$ ; without spines, 43 to  $53 \mu$ ; spines, 7 to  $11 \mu$ .

Before concluding our notes on *V. capensis* we wish to draw attention to the resemblance between it and *V. barberi* Shaw,\* which, however, appears to have a somewhat different cell structure. We have had the opportunity of examining some of Shaw's Philippine material, and we find that the spines which he gives as about  $4 \mu$  high really measure from 5 to  $7 \mu$ , or even up to  $9 \mu$ , numbers which agree well with those found by us for *V. capensis*. In general appearance, however, *V. barberi* is more like *V. globator*.

#### D. *Volvox Rousseletii* G. S. West.

West placed in this species the *Volvox* whose asexual † and sexual colonies he obtained from the Ussangu Desert. The asexual colonies were presumably considered by him to be identical with those he had

\* Shaw, W. R., *loc. cit.*, vol. xx, No. 5, May 1922, p. 496.

† West did not distinctly state, but left it to be inferred, that asexual colonies from Ussangu were examined by him. Thanks to the kindness of Professor Stiles, we have been able to examine West's slides of this material, and we find that asexual colonies are present. (We have also been able to examine Mr. Rousselet's slides of the *Volvox* from Rhodesia, thanks to Mr. Scourfield, to whom the slides were lent by Mr. Bryce.)

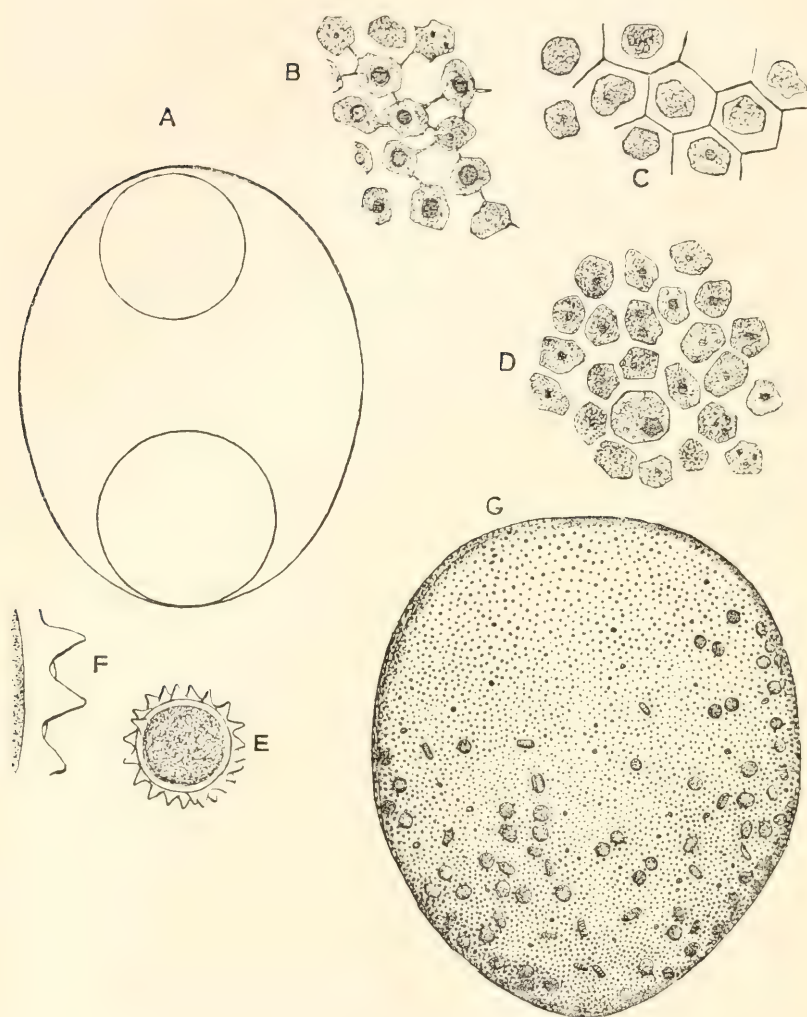
previously described from Southern Rhodesia in material collected by Mr. Rousselet, material which, as we stated above, was destitute of sexual colonies. As we have examined West's slides, we give first a supplement to his description of this *Volvox*, and after that we describe the similar forms we have obtained from Egypt and Rietfontein.

1. From the *Ussangu Desert*. (Preserved material only. Associated with *V. africanus*.)

The sexual colonies have already been described (see pp. 434, 435 of the present paper). To that description we make the following additions: The asexual colonies are broadly ovoid in shape, the posterior end being usually more pointed than the anterior. Length from 850 to 1200  $\mu$ , width from 810 to 1040  $\mu$ . The somatic cells are more densely packed at the posterior end, distance between centres here being 9  $\mu$ , while at the anterior end it is 11  $\mu$ . The daughter colonies vary in number from 6 to 10 (7 and 8 being the most usual numbers), and they reach a diameter of over 300  $\mu$  while still in the parent. Of the sexual colonies there are four good photographs by West (*Op. cit.*, 1918); they are dioecious, more pointed at the posterior end, and a little smaller than the asexual colonies. The sperm bundles are very numerous, and are crowded into the posterior four-fifths of the male coenobium; they measure from 29 to 32  $\mu$  in diameter, and are similar to those which we shall describe from Rietfontein. A drawing of a mature oospore is given in text-fig. 4, A.

2. From *Egypt*. (Preserved material only; rather scanty.)

This *Volvox* was collected in April 1924 by Mr. Douglas Simpson, who says that it appeared in rock-pools, after rains, in the Wady Khafur, Egypt. The asexual colonies are subglobose or ellipsoidal (see text-fig. 2, A), and measure up to 1000  $\mu$  in diameter. The protoplasts of the somatic cells are somewhat angular (text-fig. 2, B, C, and D), and measure from 4 to 6  $\mu$ . The protoplasmic connections are relatively short and stout. The number of daughter colonies observed was either 2 or 4, but it is extremely likely that had more coenobia been present a greater number of daughters in some of them would have been noticed; this seems to be a very variable feature in one and the same species of *Volvox*, depending apparently not only on inherent characters, but also to a large extent on external conditions. The cells of the daughters show very little differentiation before escape. The sexual coenobia are dioecious, broadly ovoid in shape,

FIG. 2.—*V. Rousseletii*, from Egypt.

A, Asexual coenobium (somatic cells omitted).  $\times 230$ .

B, C, D, Somatic cells in surface view.  $\times 1000$ . (B, stained with methylene blue; C, with Delafield's haematoxylin.)

E, Oospore (not fully mature).  $\times 400$ .

F, Portion of oospore wall more highly magnified.

G, A male coenobium.  $\times 170$ .



and the more rounded (anterior) end is free from sexual elements. The male colonies (text-fig. 2, G) are from 300 to 950  $\mu$  in diameter ; they sometimes contain daughter colonies, and appear to be very similar to the photograph taken by West from the Ussangu material.\* The sperm bundles are numerous, and measure from 35 to 42  $\mu$  across (usually 36  $\mu$ ). Two of the female coenobia measured respectively  $850 \times 1000 \mu$ , and  $1100 \times 1200 \mu$ . The oospores are numerous, up to nearly 200, and are thickly covered with spines which are broadly conical in shape (text-fig. 2, E and F), their bases almost touching. The oospores (not perfectly mature) measure 36  $\mu$  in diameter ; length of spines 5 to 6  $\mu$ .

It appears then that this *Volvox* differs only from the Ussangu one in the following respects :—

(1) The number of daughter colonies is less.

(2) The spines on the oospore are shorter (probably less mature material).

3. From *Rietfontein* (Transvaal). (Preserved and living material abundant.)

In January 1928 Mrs. Hutchinson collected *Volvox* from Rietfontein ; in February 1930 Mr. Steer (of Sea Point) obtained vigorous cultures of *Volvox* from dried mud from the same pool. From his original culture it was transferred to a large tub, whence it spread to other tubs in the garden and to his fishpond, the water of which ( $\frac{1}{2}$  to 3 feet deep) was green with it for three or four months of 1931. Altogether *Volvox* continued in abundance in Mr. Steer's garden for over eighteen months. One of us was able with this very plentiful material to obtain a series of microphotographs showing details of structure and development, the inversion of the sperm globoids, and the subsequent escape of the spermatozooids. It was found that after cold weather and rain the amount of *Volvox* diminished and that the coenobia were smaller. Usually the first, purely asexual, stage was followed by a sexual stage, and this in turn was succeeded by a second asexual one, the *Volvox* then as a rule disappearing altogether to reappear after some weeks. The *Volvox* in culture remained similar to that collected at Rietfontein. When young the coenobia are globose, very like those of *V. capensis*, but as they develop they become markedly ovoid, particularly in the case of the sexual colonies ; usually the anterior pole is broader than the posterior, but this is not always so. The number of cells is from

\* West, G. S., *op. cit.*, t. 29, 1918, fig. 1.

15,000 to 42,000 (average 20,000 to 23,000). The mature asexual colonies in a vigorous strain (Plate XX, fig. A) range from  $690 \times 754 \mu$  to  $2058 \times 2100 \mu$ ; very large colonies were, however, rare, and were only seen during the early stages of the original culture; but at the height of development of any one culture colonies about  $1300 \times 1500 \mu$  or even larger were common.

The number of daughter colonies is most often 8, but varies from 4 to 16 (see Plate XVIII, fig. A). The 8 primary gonidia are arranged alternately in two planes, one approximately equatorial, the other half-way between equator and posterior pole. The gonidia are differentiated before birth—probably either before or immediately on completion of cell-division (Plate XVIII, fig. E); they are at any rate distinguishable from the somatic cells very soon after inversion of the daughter colony by their greater size and by the possession of more than one pyrenoid. They do not begin to divide until after birth. At birth their diameter is about double that of the somatic cells (gonidia 11 to  $12 \mu$ , somatic protoplasts 4 to  $5 \mu$ ). The daughters at birth are usually large (up to  $473 \times 539 \mu$ ), but there is a wide range in size. The smallest free colony measured was  $182 \times 204 \mu$ , while the largest *in situ* was  $630 \times 672 \mu$ , but this was exceptional.

The number of daughters depends partly on the phase reached, partly on external conditions, mainly temperature and supply of nutritive material. The groups shown in the microphotographs (Plate XVIII, figs. A–D) illustrate excellently the characters seen in successive phases (A, C, and D were from one culture, B from a later one, as the corresponding phase had been missed in the earlier series):—

A. 22nd February 1930. Mr. Steer's original culture at the height of the first asexual phase. Daughter colonies up to 13 in number. Colonies large—at about this time the largest colonies (over 2 mm. in diameter) were seen.

B. 11th January 1931. From a culture derived from the above: sexual phase at its height, male colonies large, the majority of the sperm globoids having already escaped; female colonies with ripening oospores predominating. Asexual colonies with few daughters.

C. 23rd March 1930. Original culture—end of sexual phase; male colonies very few, with scattered male globoids. Asexual colonies with 2 to 5 daughters.

D. 28th March 1930. Second asexual phase. Daughter colonies very few—1 to 3, most often 2. Soon after this date *Volvox* practically disappeared from the culture for some weeks.

The vegetative cell is similar in structure to that of *V. capensis*. Plate XIX, fig. A, shows the appearance of cells at the anterior pole of a mature colony (*i.e.* one with nearly mature daughters). The position of the eyespot relative to the pole is well seen. The outer membrane shows clearly, the inner only faintly. These cells were living, the outer portions of the cilia lashing vigorously, and appearing as a blurred zone outside the limiting membrane; the basal quarter, which does not move, shows clearly, as does the mode of insertion, the bases of the two cilia being wide apart from one another.

The four other microphotographs in this plate show the difference in the arrangement of the cells at the anterior and posterior poles of a colony, as seen in surface view. B and C are portions of a young middle-aged colony treated with iodine. In B, the connecting strands and cell walls show clearly; in C, from near the posterior pole the cells are closely packed, and several show contractile vacuoles; near the bottom is an undivided gonidium. D and E are from an older colony, living and unstained, slightly more enlarged. The protoplasts are further apart and are becoming smaller, particularly in the posterior zone, fig. E, where many strands are seen to be anastomosing, and several contractile vacuoles in diastole are visible. The walls show faintly in D. Text-figs. 3, A-C, show the structure of cells from the anterior and posterior poles in greater detail.

The sexual colonies are dioecious, and the anterior region is free from reproductive elements. The male colonies (Plate XX, fig. B) are usually elongated, with numerous antheridia which develop at varying rates. Thus any one coenobium may contain all stages, from antheridial cells which are still in early stages of enlargement, up to mature sperm globoids, and in addition may show gaps where sperm globoids have formed and escaped. The colony shown in fig. B illustrates this particularly well. The number of antheridia varies from about 120 (probably more) to over 200. The sperm globoids are even more depressed than in *V. capensis*, and slightly smaller, with the 512 spermatozooids closely packed (Plate XXI, figs. A and B). In general the male globoid escapes outwards, as in *V. capensis*, and moves freely in the water for a time before the sperms escape. The delicate surrounding vesicle is left when the globoid escapes, and numerous empty vesicles can be seen in any male colony from which globoids have been escaping. The spermatozoid (text-fig. 3, D) is elongated, 10 to 13  $\mu$  long, 2  $\mu$  wide, with thickened base sometimes drawn out into a short point, has an elongated chloroplast with one

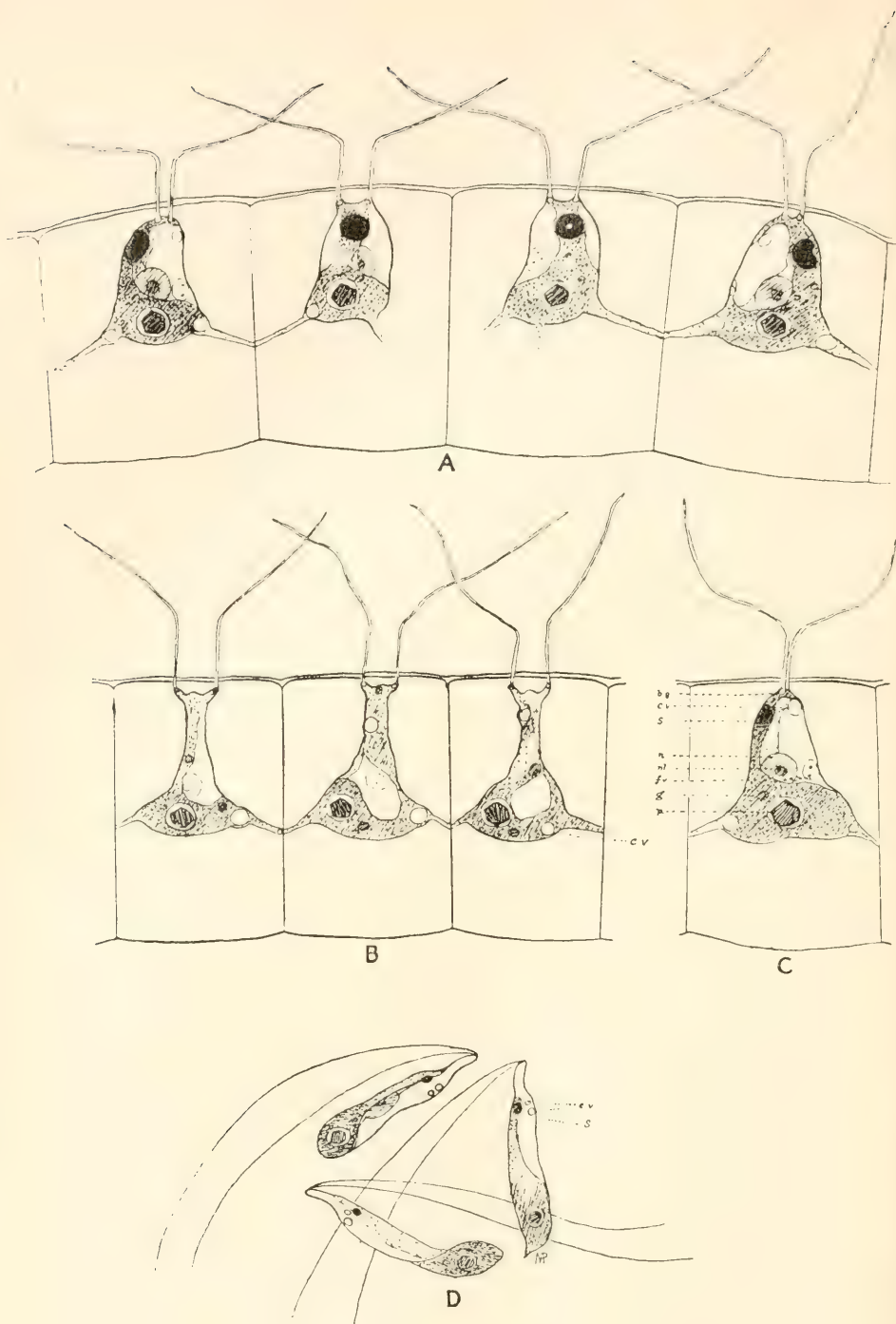


FIG. 3.—*V. Rousseletii*.

A-C, Details of cell structure.

A, Four cells at the anterior pole.

B, Cells from region of posterior pole.

C, Single cell (side view) from equatorial region.

D, Group of spermatozooids.

*s.* = eyespot ; *c.v.* = contractile vacuole ; *b.g.* = basal granule ; *n.* = nucleus ;  
*nl.* = nucleolus ; *f.v.* = food vacuole ; *p.* = pyrenoid ; *g.* = glycogen.

A-C  $\times 2000$  ca. D  $\times 2500$ .



pyrenoid, central elongated nucleus, red eyespot, and 2 contractile vacuoles near the anterior end, below the base of the elongated hyaline beak. At the apex of the beak are inserted the two long backwardly directed cilia (up to  $23\ \mu$  in length). The spermatozooids swim actively in the water, or they may be seen inside the coenobium, where they move in an amoeboid manner, the cilia remaining motionless.

The female coenobia are usually slightly larger than the male; they produce from 60 to over 200 oogonia, each of which develops a single large flask-shaped oosphere (Plate XXI, fig. D), the apex of which lies a short way below the surface of the colony and is connected by protoplasmic strands with neighbouring cells. Later, presumably after fertilisation, the oospore rounds off and lies entirely within the peripheral zone of the parent (Plate XXI, fig. E). In the young colony shown in optical section in Plate XX, fig. D, most of the oospores have sunk inwards, but a few flask-shaped oospheres are still visible round the wall. The oospore develops as in *V. capensis*; the shape of the conical spines, however, is different—they are longer, slightly narrower, and usually more numerous in an optical section (Plate XXI, fig. C, and text-fig. 4, B). The size of the oospore, including spines, is about the same as in *V. capensis*; hence since the spines are longer, the spore body in *V. Rousseletii* is actually slightly smaller. Plate XX, figs. E and F, show two large female colonies with nearly mature oospores. The absence of gaps in the cell network is noticeable.

Occasionally mixed colonies containing asexual daughters and either sperm globoids (Plate XX, fig. C) or oospores are seen. According to our experience these mixed colonies may occur in any of our forms as the strain advances in age, hence usually towards the end of the sexual phase, never in the early stages of development.

In *V. Rousseletii* as a rule the sexes are quite distinct, but very rarely a male globoid occurs in an otherwise purely female coenobium. Such cases occurred so rarely during the time (18 months) that the Rietfontein cultures were under observation, that they may be regarded as exceptions to the general rule.

Dimensions of *V. Rousseletii*. (Mr. Steer's Rietfontein culture.)

Mature asexual colony,  $690 \times 754\ \mu$  to  $2058 \times 2100\ \mu$ .

Mature sexual colony, male,  $646 \times 753\ \mu$  to  $1184 \times 1378\ \mu$ ; average  $700 \times 770\ \mu$ .

Mature sexual colony, female,  $646 \times 711\ \mu$  to  $1058 \times 1292\ \mu$ ; average  $840 \times 960\ \mu$ .



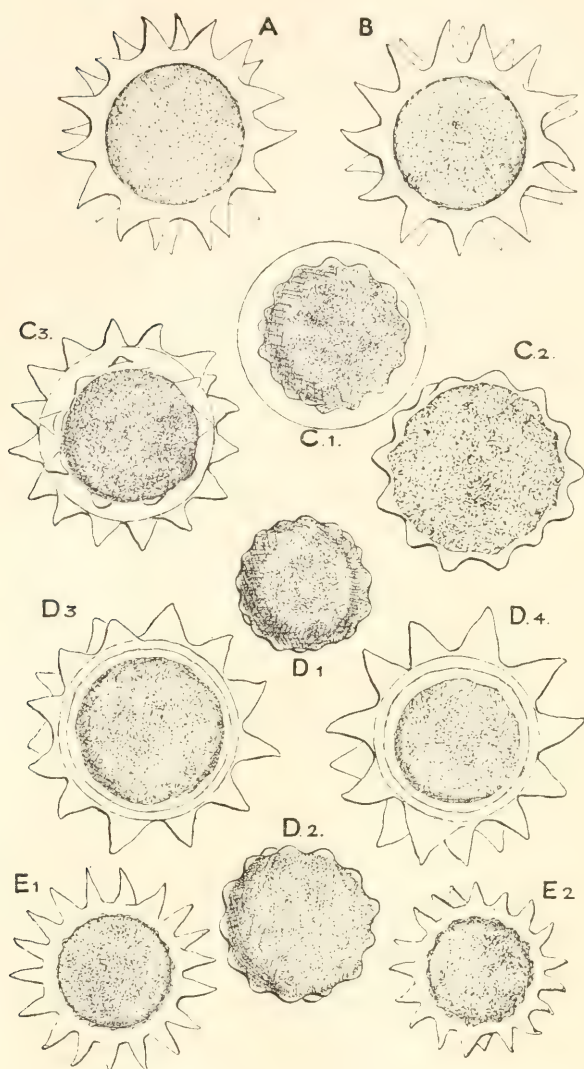


FIG. 4.—*Volvox* oospores. A, B, *V. Rousseletii*. A, from Ussangu.  
B, from Rietfontein.

C, *V. capensis*, from the Cape Flats.

D, *V. capensis* f. *rhodesiensis*, from Old N'gamo.

E, *V. amboensis*.

C and D show different stages of development.

A, B, C<sub>3</sub>, D<sub>3</sub>, and D<sub>4</sub> are mature oospores with fully developed exospore.

D<sub>3</sub> and D<sub>4</sub> are from the same coenobium.

All figures  $\times 600$ .

Mature daughter colony,  $182 \times 204 \mu$  to  $630 \times 672 \mu$ ; average diameter 300 to 400  $\mu$ .

Somatic cell: anterior pole 11 to 17  $\mu$ ; posterior pole 6 to 11  $\mu$ .

Somatic protoplast: anterior pole 5 to 8  $\mu$ ; posterior pole 3 to 6  $\mu$ .

Somatic protoplast in daughter colony at birth, 4 to 6  $\mu$ .

Gonidium protoplast in daughter colony at birth, 13 to 15  $\mu$ .

Number of somatic cells, 14,000 to 42,000; average 20,000 to 23,000.

Number of daughter colonies, 1 to 16, usually 6 to 10.

Number of sperm globoids, 108 to 214, probably more.

Number of oospores, 60 to 201; average 160 to 170.

Size of sperm globoid, 35 to 43  $\mu$ .

Size of oospore with spines, 44 to 59  $\mu$ ; without spines, 35 to 44  $\mu$ ; spines, 5 to 10  $\mu$ .

4. From *Eliazer Pan* (Potchefstroom) and *Brakpan*, both in the Transvaal.

At Potchefstroom a similar *Volvox* with both male and female colonies was found associated with *V. aureus* (Plate IX, fig. A). From Brakpan no sexual colonies were obtained.

5. From *Sedudu*, Linyanti River, Bechuanaland Protectorate.

In most of the vleis, etc., examined in this district the monoecious *V. capensis* was present. At Sedudu, however, in a small pan *V. Rousseletii* with typical male colonies containing numerous antheridia (between 200 and 300) was found (Plate XXII, fig. A) associated with ovoid asexual colonies; the cell network appears finer than in *V. capensis*. *V. Rousseletii* was also found in some of the backwaters of the Linyanti River itself.

6. From *Grahamstown*, Cape Province. (Collected by Miss L. Britten.)

The material was nearly all asexual, somewhat badly attacked by Rotifers. From the ovoid form of the large asexual colonies, and from the single young sexual colony with large oospheres and no sign of male elements, this *Volvox* is probably *V. Rousseletii*, but further sexual material is necessary before it can be fully identified. The asexual colonies are large—of those measured, all immature, the dimensions ranged from  $948 \times 990 \mu$  to  $1120 \times 1184 \mu$ , with from 8 to 12 daughters, of which most had still not inverted. The single sexual colony measure  $495 \times 559 \mu$ , and contained about 40 large bodies, apparently eggs which had rounded off but had not yet laid down their walls.

Protoplasts range in size from 5 to 8  $\mu$ . The record is interesting, since it is the first from the Eastern Province.

From the foregoing the *Volvox* which now follows appears to differ

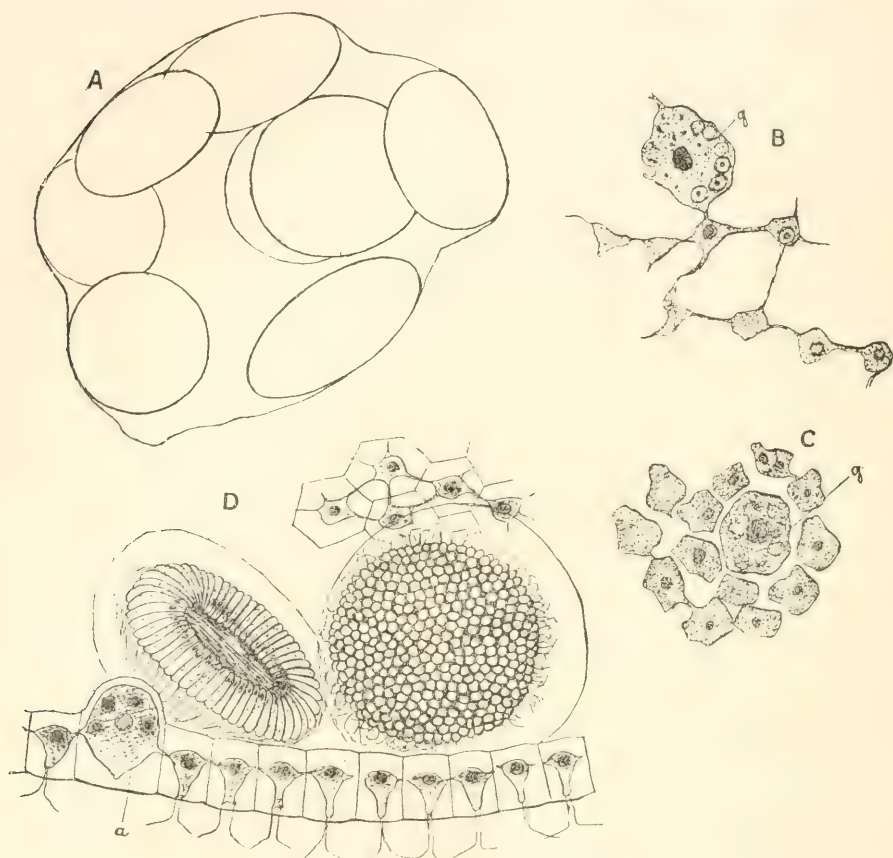


FIG. 5.—*V. Rousseletii* f. nov. *kaokoensis*.

A, Asexual coenobium with 8 daughters.  $\times 60$ .

B, C, Somatic cells and gonidia (g) in surface view.  $\times 1000$ .

D, Sperm globoids and peripheral cells, (a) antheridial cell.  $\times 900$ .

in certain respects, chiefly in the form of the oospore, but we have examined only two samples (preserved). The material was mixed with *Lemna paucicostata* and a large *Oedogonium*, and was somewhat scanty. It was collected on two separate occasions from one locality. In the absence of fuller material we classify this tentatively as a *form* of the above.

7. *V. Rousseletii* forma *kaokoensis* f. nov.

Forma oosporis paullum minoribus, spinis conicis brevioribus quam in forma typica.

From the Kaokoveld, South-West Africa. Collected by Dr. R. F. Lawrence in 1925, and by Dr. K. H. Barnard in February 1926, from a small rain-water pool on granite at Kamanyab in the Kaokoveld.

The asexual colony is subglobose to ellipsoidal, 800 to 1600  $\mu$  in diameter, with the broadest part often a little anterior to the equator. The distance between the centres of the somatic cells is from 9 to 15  $\mu$ ; protoplasmic connections are distinct (Plate XXIII, fig. D), and appear to be commonly four (sometimes five) in number (text-fig. 5, B); thus there may be a difference between these cells and those of the other forms described. Some markedly ellipsoidal daughters were observed (text-fig. 5, A), but these are the exception, the shape usually being subspherical (Plate XXII, figs. B and C). The number of daughters varies from 2 to 9, though 7 is the commonest; the size on escape is from 300 to 500  $\mu$ , that is, rather large.

The sexual colonies are dioecious. The male colony (Plate XXII, fig. D) is ovoid, with 120 to 150 or more antheridia which develop into typical depressed globoids of 512 sperms, 30 to 43  $\mu$  in diameter (text-fig. 5, D, and Plate XXIII, figs. E and F). The female colony (Plate XXII, fig. E, and Plate XXIII, fig. A) is broadly rounded at the anterior end. From 120 to 227 oospores have been counted. The oospore wall is covered with conical spines, which may be straight or curved (Plate XXIII, figs. B and C).

This form of *Volvox* differs from the preceding in the occasional elongated shape of its daughter colonies, possibly in the nature of its somatic protoplasts, and in the form of the ripe oospore.

Dimensions of *V. Rousseletii* forma *kaokoensis*.

Mature asexual colony,  $525 \times 600$  to  $1240 \times 1260$  (to 1600)  $\mu$ .

Mature sexual colony, male,  $657 \times 730$  to  $876 \times 905$   $\mu$ .

Mature sexual colony, female,  $700 \times 755$  to  $714 \times 777$   $\mu$  (few seen).

Mature daughter colony,  $294 \times 315$  to  $379 \times 481$   $\mu$ .

Somatic cell, 9 to 18  $\mu$ .

Somatic protoplast, 5 to 7  $\mu$ .

Somatic protoplast in daughter at birth, 4 to 5  $\mu$ .

Gonidium protoplast in daughter at birth, 9 to 13  $\mu$ .

Number of somatic cells, 21,000 to 30,000.

Number of daughter colonies, 2 to 9, most often 7.

Number of sperm globoids, 120 to 150 or more.



Number of oospores, 130 to 227.

Size of sperm globoid, 30 to 43  $\mu$ .

Size of oospore with spines, 44 to 46  $\mu$ ; without spines, 35 to 38  $\mu$ ; spines, 5 to 7  $\mu$ .

E. *Volvox amboensis* sp. nov.

We proceed next to describe a *Volvox* we obtained from Ovamboland; this, though resembling *V. Rousseletii* in many ways, differs from it rather markedly, and we have decided to institute for it a new specific name. We have been able to observe it only in preserved material, and from one collection, and we have not been able to obtain satisfactory photographs, as the large coenobia are very fragile and readily collapse. The name *amboensis* is proposed to indicate its occurrence in the land occupied by the Ovambo tribes.

Coenobiis asexualibus late ovoideis, 220–1300  $\mu$  (plerumque 800–1000  $\mu$ ) latis, cellulis ca. 30,000–50,000, in parte posteriore densiore aggregatis; coenobiis infantibus 1–14 (vulgo 8), interdum in coenobiis sexualibus inclusis. Coenobiis sexualibus majoribus, usque ad 2 mm. latis, bisexualibus; ovoideis; antheridiis 31–33  $\mu$  latis; oosporis numerosis (ad 700) arcte congestis, in ca. tertiam partem coenobiis carentibus (interdum in utroque polo absentibus), sine spinis 30–34  $\mu$  latis, spinis cavis, conicis, acutis, ad 5–7  $\mu$  longis obtectis.

Collected by Dr. K. H. Barnard in February 1921, and by Dr. Barnard and Dr. R. F. Lawrence in February 1923, from Ongka in Ovamboland, South-West Africa. Dr. Barnard states that he visited the water-hole in which it occurred on two separate occasions, and that both times the water was green with the *Volvox* (no filamentous algae were present). The locality is about 15 miles north of Ondongua.

This is a large and very variable *Volvox* with an astonishingly large number of oospores. The asexual coenobia are broadly ellipsoidal in shape and vary in size, a large one measuring  $1200 \times 1300 \mu$ . The number of cells has been roughly computed as from 30,000 to 50,000; they are densely packed at the posterior end. The somatic protoplasts are pear-shaped in side view (text-fig. 6, C). The protoplasmic processes are difficult to see (the material is preserved in alcohol); stained with gentian violet they appear as fine strands, sometimes anastomosing (text-fig. 6, B). The two cilia are inserted near together at the pointed end, which reaches nearly to the surface of the common envelope. There is one pyrenoid in each cell, large and nearly filling



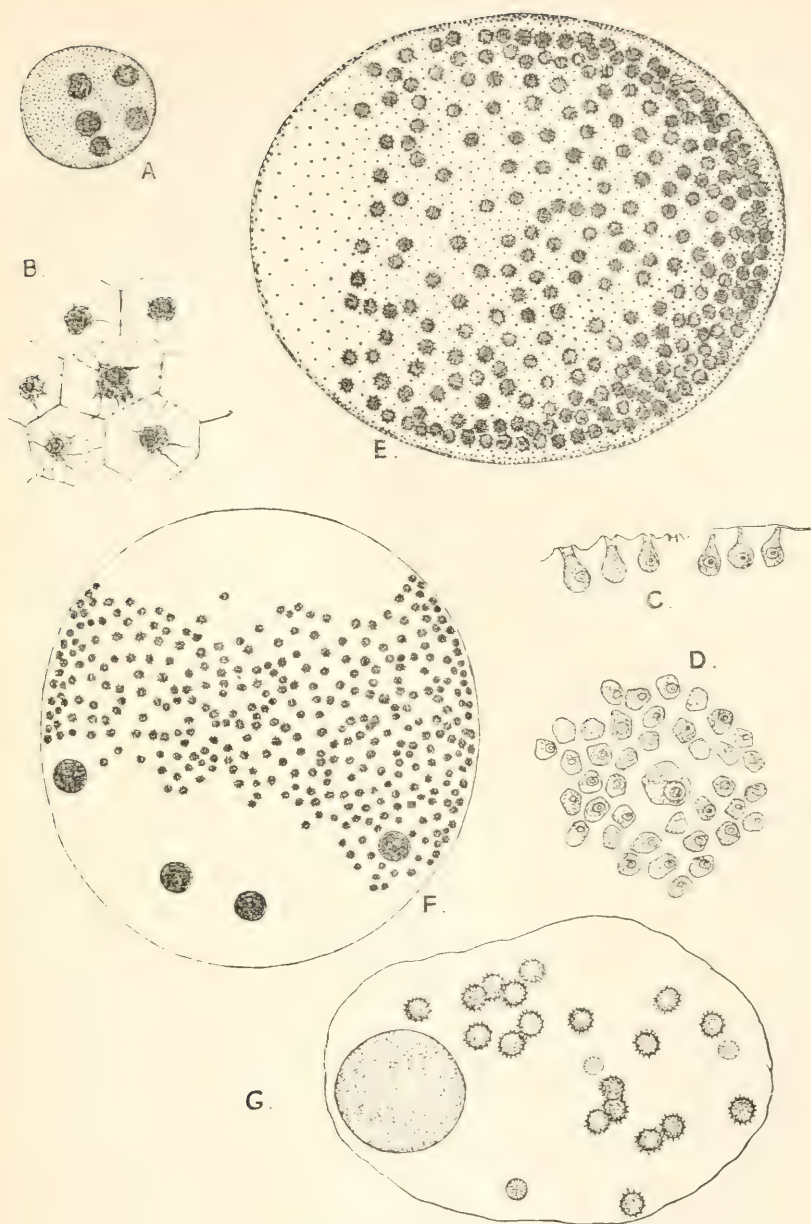


FIG. 6.—*V. amboensis* sp. nov.

A, Unusually small asexual coenobium with 5 daughters.  $\times 90$ .

B-D, Somatic cells: B and D in surface view, C in side view. B  $\times 1000$ ; C, D  $\times 700$ .

E, Female coenobium.  $\times 40$ .

F, Female coenobium containing 4 young daughter colonies.  $\times 30$ .

G, An irregular coenobium containing 19 oospores, 3 sperm bundles, and 1 daughter colony.  $\times 70$ .

the protoplast. The cells vary very much in size, not only according to age, but also according to the position in the coenobium. They are more closely packed in asexual than in sexual colonies. The distance between their centres may be twice as great at the anterior as at the posterior end (of a sexual colony)—20 to 10  $\mu$ . The gonidia are late in developing; a free coenobium measuring  $640 \times 680 \mu$  was noticed with a few cells only just beginning to be differentiated. The daughter colonies vary in number; sometimes only 1 is present, though 8 is a common number. Several colonies were found with 9 daughters, three with 10, three with 12, and one with 14. On escape they measure from 135 to 200  $\mu$ . Sometimes daughter colonies are found in coenobia containing male and female elements (text-fig. 6, G).

The sexual colonies (text-fig. 6, E and F) are apparently monoecious and protandrous; they may contain daughter colonies. The anterior end is sometimes more pointed than the other. They are ovoid in shape, often with only a slight difference in the length of the two axes (Plate XXIV, figs. A and B). They are larger than the asexual colonies, some attaining a diameter of 2 mm., though others are quite small. The material to hand was over-ripe and male elements were rare, but a few scattered sperm bundles in the midst of ripe oospores were observed, 31 to 33  $\mu$  in diameter. As a rule the oospores are crowded into about two-thirds of the coenobium; sometimes a free space is observed at both ends (text-fig. 6, F). The number of oospores is very variable; occasionally in an unusually small coenobium there are only 20—mostly there are several hundreds, even up to 700. This is a larger number than has been recorded for any previously described *Volvox*: in *V. globator* there are generally 30, though the number may be 64; *V. Rousseletii* has 200, *V. Barberi* about 224, *V. perglobator* from 300 to 400.\* The oospore is densely covered with conical pointed spines, spirally arranged, about 16 or 17 visible round the periphery (text-fig. 4, E, and Plate XXIV, fig. C). The diameter without spines is from 30 to 36  $\mu$ ; the spines vary in length from 5 to 7  $\mu$ ; frequently the measurements are 30  $\mu$  without spines, 40  $\mu$  with spines. The oospores, it will be seen, are rather small. The spines are hollow, and are rather more pointed than in the forms above described (recalling those of *V. Merrilli* Shaw,† but shorter), the tip

\* Powers, J. H., Trans. Amer. Micr. Soc., vol. xxviii, 1906, p. 162. *V. perglobator* is comparable to the Ovamboland *Volvox* in size and in its large number of oospores, but is dioecious, and the somatic protoplasts form a reticulum, the cell-body becoming hardly noticeable.

† Shaw, W. R., loc. cit., vol. xx, No. 5, 1922, pl. i, fig. 3.

is often inclined a little to one side, the bases are narrow. Two oospores from one coenobium are shown in text-fig. 4, E, drawn on the same scale as the oospores of *V. Rousseletii* and *V. capensis* to facilitate comparison.

Dimensions of *V. amboensis* sp. nov.

Mature asexual colony, largest seen  $1200 \times 1300 \mu$ .

Mature sexual colony,  $1100 \times 1500 \mu$ —over 2 mm.

Mature daughter colony,  $135 \times 200 \mu$ .

Somatic cell: anterior pole  $20 \mu$ ; posterior pole  $10 \mu$ .

Somatic protoplast, 5 to  $7 \mu$ .

Number of somatic cells, 30,000 to 50,000.

Number of daughter colonies, 1 to 14, most often 7 to 8.

Number of sperm globoids—not known.

Number of oospores, 20 to over 400.

Size of sperm globoid, 30 to  $33 \mu$ .

Size of oospore with spines, 40 to  $50 \mu$ ; without spines, 30 to  $37 \mu$ ; spines, 5 to  $7 \mu$ .

This *Volvox* is specially noticeable on account of its variability, the large size of the sexual coenobia, the mixed colonies, and the number of rather small oospores with pointed spines.

In order to compare the species of *Volvox* referred to in this paper, some of their characteristics have been set out in parallel columns in the table on p. 466.

#### SUMMARY.

In the foregoing paper a short history of *Volvox* in Africa has been given.

The occurrence of *V. aureus* Ehrenb. has been noted in several localities from which it was not previously known, viz. the Transvaal (Eliazer Pan, Potchefstroom, and Weltevreden West), Rhodesia (N'gamo and Old N'gamo), and the Bechuanaland Protectorate (vleis and backwaters of the Linyanti River).

*V. africanus*, G. S. West, which had been recorded previously only from Albert Nyanza, the Ussangu Desert, and the Philippines, has been described from pools in the neighbourhood of Kazungula on the Linyanti River (asexual only).

A *Volvox* from the Cape Flats has been described as a new species, *Volvox capensis*, intermediate in character between *V. globator* and *V. Rousseletii*. A slightly divergent form of this species has been

	Length of asexual colony.	Gonidia at escape.	Number of daughter colonies.	Size of daughter colonies on escape.	Daughters in sexual colonies.	Distribution of sexes.	Shape of sexual colony.	Size of sexual colony.	Number of speria bundles.	Form and diameter of speria bundles.	Number and type of oospores.	Size of oospore without spines.	Length of spines.
<i>Volvox aureus</i> . . . . .	300-850 $\mu$ , rarely over 500 $\mu$ .	Large, sometimes divided.	4-12	200-250 $\mu$	Often	Diocious or monoecious	Globose	300-500 $\mu$	Very numerous.	Platelets 12-18 $\mu$	1-15 smooth	60-70 $\mu$	..
<i>aureus</i> , from Potchefstroom.	300-555 $\mu$	Large, often in 2-4-celled stage.	4-13	180 $\mu$ -	Occasionally	Diocious	Globose	400-520 $\mu$	Very numerous.	Platelets 14-20 $\mu$	4-11 smooth	61-73 $\mu$	..
<i>aureus</i> , from N'gamo and the Linyanti.	816 $\mu$	Large, often in 2-4-celled stage.	6-11	194-243 $\mu$	Occasionally	Diocious	Globose	300-625 $\mu$	Very numerous.	Platelets 14-20 $\mu$	7-11 smooth	65-84 $\mu$	..
<i>africanus</i> . . . . .	345-646 $\mu$	May have fully developed and produced great-grand-daughters.	2-6 in pairs	258 $\mu$	Not seen	Diocious; occasionally monoecious	Ellipsoidal	♂ and ♀ slightly smaller, ♂ much smaller.	100-400	Platelets	12-80 smooth	43-45 $\mu$	..
<i>globator</i> . . . . .	400-800 $\mu$ , rarely over 1200 $\mu$ .	Not fully grown; undivided.	8, rarely 14	150-200 $\mu$ , rarely $\rightarrow$ 320 $\mu$	Not as a rule.	Monoecious	Globose to broadly ellipsoidal.	Slightly smaller than asexual.	1-15, usually about 5.	Globoids and platelets 22-31 $\mu$	12-64, usually about 30 spiny; 66-221 spiny	45-55 $\mu$	5-8 $\mu$
<i>Barberi</i> . . . . .	950 $\mu$	Small	3-6	$\rightarrow$ 300 $\mu$	..	Monoecious	Ellipsoidal.	As above	Few	..	..	34 $\mu$	4-9 $\mu$
<i>capensis</i> , from the Cape Flats.	764-1292 $\mu$	Undivided. Diameter 2-3 $\times$ that of somatic cells.	4-12, rarely $\rightarrow$ 20	139-495 $\mu$	Occasionally in late phase.	Monoecious	Globose to broadly ellipsoidal.	495-1034 $\mu$	5-13, sometimes $\rightarrow$ 19.	Globoids 60-160 33-44 $\mu$	60-160 spiny	37-49 $\mu$	5-8 $\mu$
<i>capensis</i> f. <i>rhodesiensis</i> .	1142 $\mu$	As above	5-19	388 $\mu$	As above	Monoecious	As above	640-1313 $\mu$	5-35	Globoids 32-38 $\mu$	50-220 spiny	40-53 $\mu$	7-11 $\mu$ or 9-13 $\mu$
<i>Roussetelii</i> , from Ussangu	880-1200 $\mu$	Small, undivided.	6-10	320 $\mu$ +	As above	Diocious	Ovoid; posterior end more pointed.	Smaller than asexual.	Numerous	Globoids 29-32 $\mu$	120-150 spiny	36-40 $\mu$	7-10 $\mu$
<i>Roussetelii</i> , from Egypt.	1000 $\mu$	As above	2-4	200 $\mu$ +	As above	Diocious	As above	About the same as asexual.	Numerous	Globoids 35-42 $\mu$	200 $\pm$ spiny	36 $\mu$	5-6 $\mu$
<i>Roussetelii</i> , from Rietfontein.	754-2100 $\mu$	As above	1-16	204-672 $\mu$	As above	Diocious	As above	Usually smaller than asexual.	108-214 or more.	Globoids 33-43 $\mu$	60-201 spiny	35-44 $\mu$	6-10 $\mu$
<i>Roussetelii</i> f. <i>laokoensis</i> .	600-1260 (-1600) $\mu$	As above	2-9	315-481 $\mu$	As above	Diocious	More pointed posteriorly $\pm$ both ends equally rounded.	Smaller than asexual.	120-150 or more.	Globoids 30-43 $\mu$	130-227 spiny	35-38 $\mu$	5-7 $\mu$
<i>amboensis</i> . . . . .	800-1300 $\mu$	As above	1-14	160-200 $\mu$	As above	Monoecious ?	Both ends equally rounded.	Larger than asexual.	Few ?	Globoids 30-33 $\mu$	$\rightarrow$ 700 spiny	30-37 $\mu$	6-7 $\mu$



described from Rhodesia (N'gamo) and the Bechuanaland Protectorate (vleis and backwaters of the Linyanti River).

*V. Rousseletii* G. S. West, previously fully known only from the Ussangu Desert, has now been described from Egypt, from the Transvaal (Rietfontein, Eliazer Pan, and Brakpan), from the Bechuanaland Protectorate (Sedudu), and from the Eastern Province (Grahamstown). Individuals from Rietfontein have been studied in the living condition, and our knowledge of the species has been extended. A form from the Kaokoveld (South-West Africa) has been noted which seems to show certain different peculiarities.

A new species, *V. amboensis*, from Ongka in Ovamboland, has also been described.

#### CONCLUSION.

From the above it is obvious that the genus *Volvox* in its broadest sense is widespread in Africa, and includes many distinct species and forms. There is here an extensive field for study, and it remains for further research to find whether some of these forms are not merely local variations of a single very variable species, or whether they remain true if grown under different conditions.

The authors desire to express their gratitude to Professor F. E. Fritsch, F.R.S., of the East London College, University of London, for his very kind and valuable help and advice.

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The microphotographs illustrating this paper have all been taken by the junior author, with the exception of two of *V. amboensis* kindly taken for us by Professor Iyengar.



## EXPLANATION OF PLATES.

## PLATE IX.

*Volvox aureus* Ehrenb., from Eliazer Pan, Potchefstroom, Transvaal.

FIG.

- A. With *V. Rousseletii* (the latter larger and darker).  $\times 38$ .
- B. Group showing male, female, and asexual coenobia.  $\times 70$ .
- C. Young female coenobium.  $\times 108$ .
- D. Young male coenobium.  $\times 116$ .

## PLATE X.

*V. aureus* Ehrenb., from Potchefstroom.

- A. Asexual colony with 6 daughters, one half-inverted.  $\times 150$ .
- B. Somatic cells, protoplasmic connections just visible.  $\times 800$ .
- C. Sperm platelets.  $\times 1000$ .
- D. Female colony (polar view) with 11 ripening oospores.  $\times 108$ .
- E. Two oospores *in situ* (still young).  $\times 280$ .

## PLATE XI.

*V. aureus* Ehrenb.

- A. ♂ and ♀ colony from Potchefstroom.  $\times 83$ .
- B, C. From Old N'gamo. B, two female colonies, 1 male colony, and a colony of *Pleodorina californica* (reproductive).  $\times 70$ . C, asexual colony with 7 mature daughters.  $\times 83$ .

## PLATE XII.

A, B. *V. africanus* G. S. West, from the Linyanti River.

Two asexual colonies with 3 and 2 large daughters respectively.  $\times 110$ .

C-E. *V. capensis* sp. nov., from the Cape Flats.

- C. Very young strain collected less than a week after the formation of the pool; normal asexual colonies and a few "juveniles" formed on germination of oospores.  $\times 36$ .
- D. Group from an older strain; asexual colonies, young sexual colonies with sperm bundles and oospheres, older sexual colonies with nearly ripe oospores. The large daughters in the colony near the top on the right are preparing to invert. Several colonies contain Rotifers and show signs of the damage they do.  $\times 28$ .
- E. Portion of sexual colony showing nearly mature oospheres (one detached) and a single sperm globoid.  $\times 400$ .

PLATE XIII.

*V. capensis* sp. nov., from the Cape Flats.

FIG.

- A. Group of asexual and sexual colonies; of the latter some show sperm plates and oospheres, the others ripening oospores. Several attacked by a fungal (Chytridiaceous) parasite.  $\times 40$ .
- B. Portion of a young asexual coenobium showing form of the cells, and a developing daughter colony.  $\times 300$ .
- C. Young sexual colony.  $\times 102$ .
- D. Asexual colony, polar view.  $\times 83$ .
- E. Sexual colony with nearly mature oospores.  $\times 65$ .

PLATE XIV.

*V. capensis* sp. nov.

- A. From Belvedere Road, Cape Flats. Hot weather form, November 1930.  $\times 30$ .
- B, C. From Scanlan's Vlei, Wetton Road. B, with 2 Rotifers and 6 eggs.  $\times 83$ .  
C, attacked by fungus.  $\times 40$ .
- D. Rotifer parasitic on *Volvox* (Wetton Road). Individual freed from the colony (killed with osmic acid).  $\times 400$ .

PLATE XV.

*V. capensis*, from the Cape Flats.

- A. Living cells from the anterior pole.  $\times 1000$ .
- B. Cells killed with iodine from the posterior pole of a nearly mature asexual colony.  $\times 1000$ .
- C. Mature sperm globoid in side view; D, the same in surface view.  $\times 1000$ .
- E. Group of nearly ripe oospores *in situ*.  $\times 500$ .
- F. Single oospore further enlarged.  $\times 800$ .

PLATE XVI.

*V. capensis* f. nov. *rhodesiensis*, from N'gamo.

- A. Group of young (and one mature) sexual colonies, with a single immature asexual colony.  $\times 40$ .
- B. Sperm bundle in side view; C, the same in surface view.  $\times 1000$ .
- D. Young oogonium with sperms round the base.  $\times 1000$ .
- E. Nearly mature oospore.  $\times 750$ .

## PLATE XVII.

*V. capensis* f. *rhodesiensis*. A and B from N'gamo; C and D from a pool near the wagon road from Kazungula to Kasani, on the Linyanti River.

FIG.

- A. Young sexual colony with sperm globoids and oospheres.  $\times 83$ .
- B. Cell detail from the same colony.  $\times 1000$ .
- C. Young asexual colony with 19 daughters in early stages of cell division.  $\times 52$ .
- D. Colony with nearly ripe oospores; about ten rounded gaps in the cell network indicate the positions of escaped sperm globoids.  $\times 63$ .

## PLATE XVIII.

*V. Rousseletii* (Mr. Steer's Rietfontein culture).

- A-D. Successive phases showing varying proportions of asexual to sexual colonies and varying numbers of daughter colonies. Description in text.
  - E. Mature daughter *in situ* showing gonidia (under cover slip).
- A and D  $\times 15$ . B  $\times 12$ . C  $\times 25$ . E  $\times 150$ .

## PLATE XIX.

*V. Rousseletii* (Mr. Steer's Rietfontein culture), cell detail.

- A. Living cells from the anterior pole of a mature colony, showing shape and position of eyespots, and insertion of cilia.  $\times 1000$ .
- B. Cells from the anterior pole, and C, from the posterior pole, of a middle-aged colony killed with iodine.  $\times 800$ .
- D, E. Similar cells (living) from an older colony.  $\times 900$ .

## PLATE XX.

*V. Rousseletii*, from Rietfontein.

- A. Asexual colony showing arrangement of daughter colonies (8th gonidium, abortive, on the right).
  - B. Mature male colony; C, mixed colony with 3 daughters and numerous sperm globoids.
  - D-F. Female colonies: D, still young, some oospheres not yet fertilised; E, F, nearly mature.
- A and F  $\times 60$ . B and D  $\times 65$ . C  $\times 50$ . E  $\times 70$ .

## PLATE XXI.

*V. Rousseletii* (Mr. Steer's Rietfontein culture).

- A. Free sperm globoid (killed with csmic acid) in surface view.  $\times 750$ .
- B. Young globoid soon after inversion, in side view. The line of demarcation between green base and colourless anterior portion shows clearly.  $\times 1000$ .
- C, E. Nearly mature oospores *in situ*.  $\times 800$  and  $\times 325$  respectively.
- D. Mature oosphere in side view.  $\times 800$ .

PLATE XXII.

FIG.

A. *V. Rousseletii*, male colony from Sedudu.  $\times 83$ .

B-E. *V. Rousseletii* f. *kaokoensis*: B, asexual ( $\times 50$ ), C, mixed ( $\times 50$ ), D, male ( $\times 63$ ), E, female colonies ( $\times 35$ ).

PLATE XXIII.

*V. Rousseletii* f. nov. *kaokoensis*.

A. Colony with ripe oospores (stained Delafield's haematoxylin).  $\times 55$ .

B, C. Oospores.  $\times 800$ .

D. Cells from a male colony with a developing sperm globoid (bowl stage).  $\times 800$ .

E, F. Sperm globoid in surface view and side view.  $\times 800$ .

PLATE XXIV.

A-C. *V. amboensis* sp. nov.

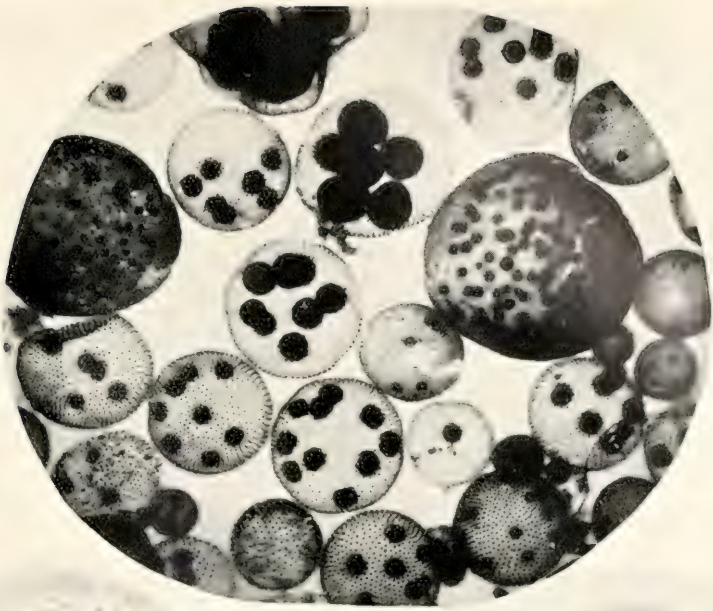
A, B. Female colonies: A, with anterior pole; B, with posterior pole tipped towards observer.  $\times 40$ . (Microphotographs by Professor Iyengar.) A,  $1100 \times 1500 \mu$ .

C. Mature oospore.  $\times 800$ .

D. A typical *Volvox* vlei on the Cape Flats (Ottery Road, Wynberg). *Oxalis natans* in flower on the water.

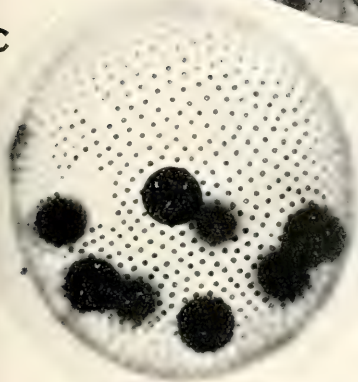




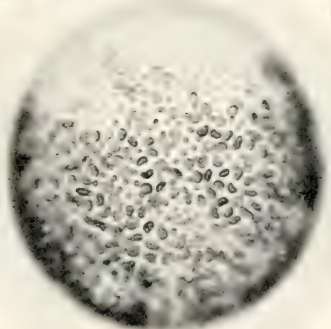


A

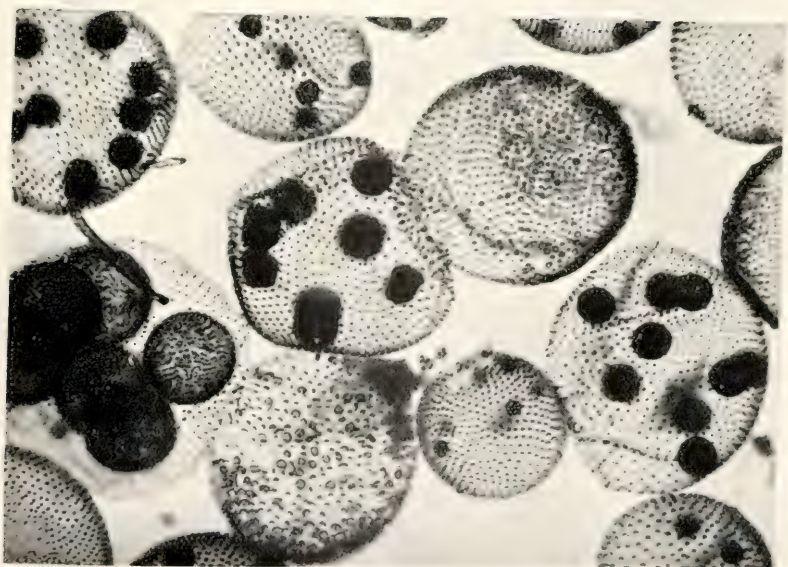
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D

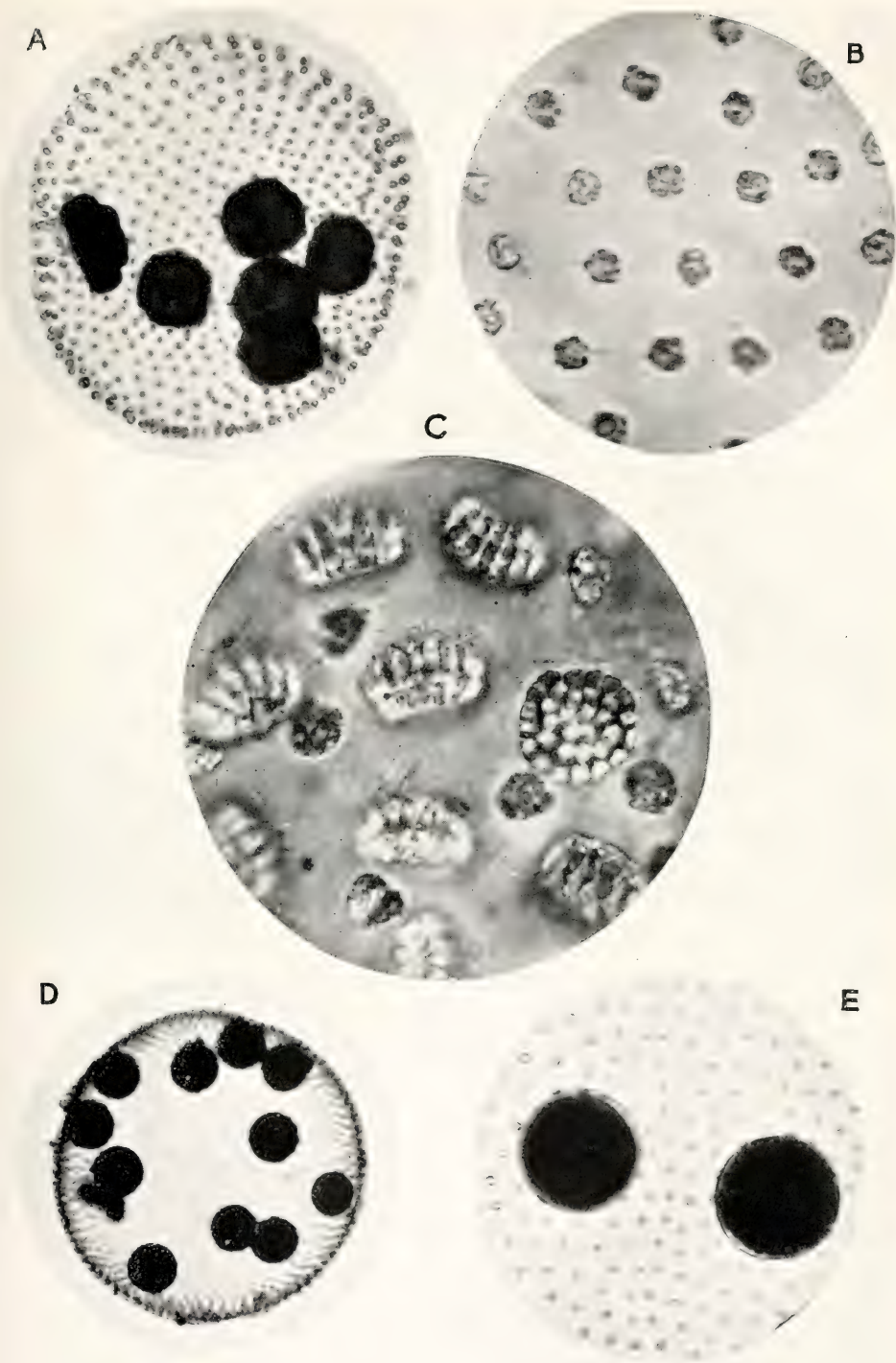


B



SOUTH AFRICAN VOLVOX.

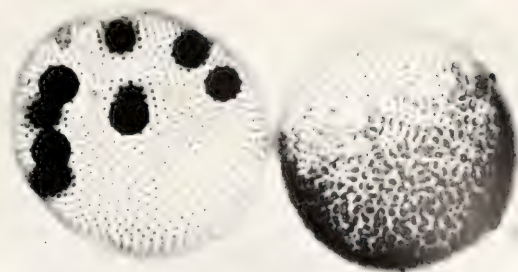




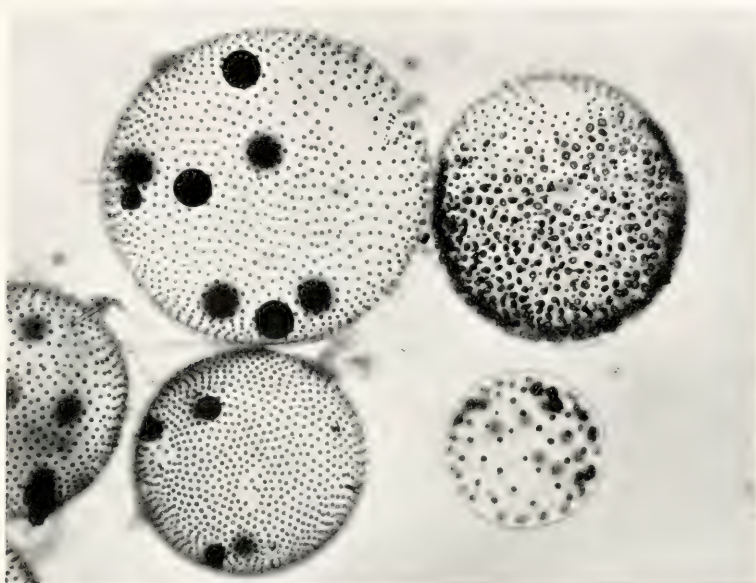
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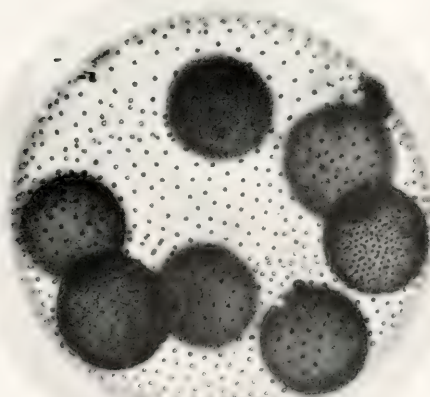
A



B



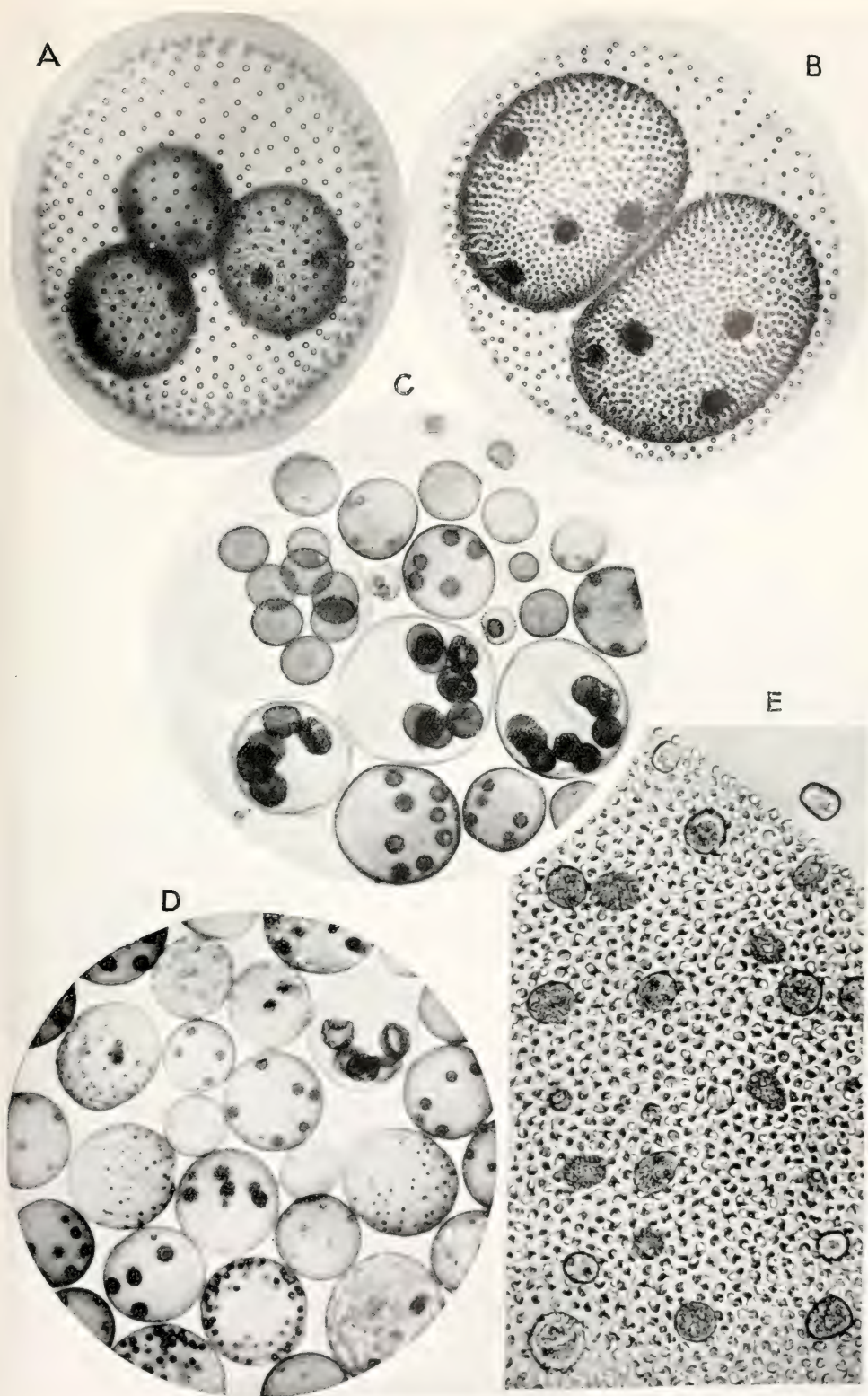
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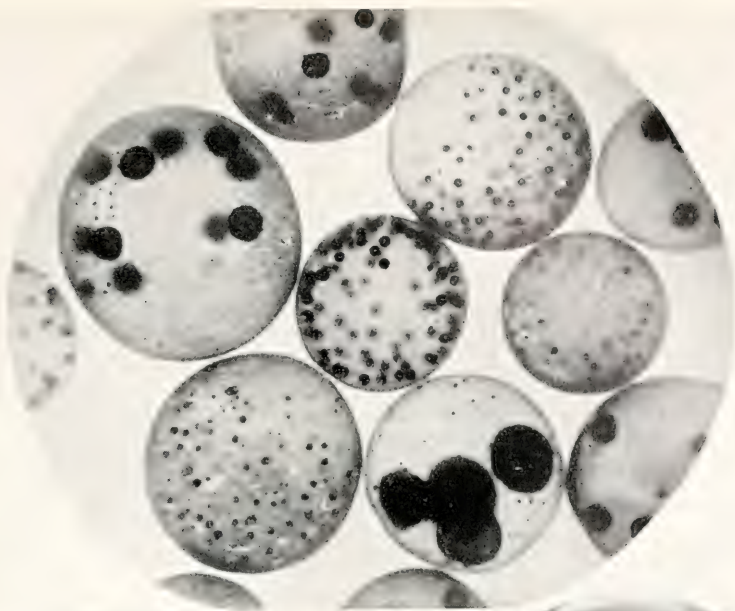




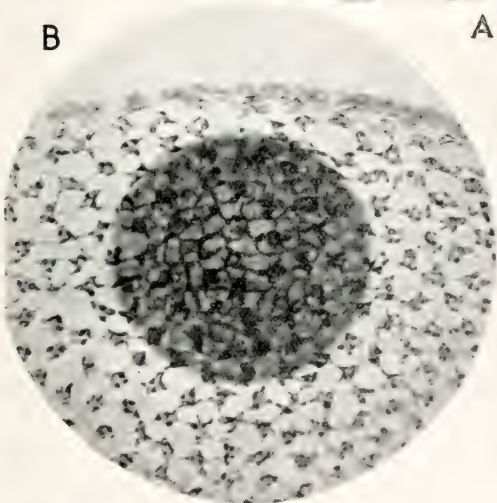


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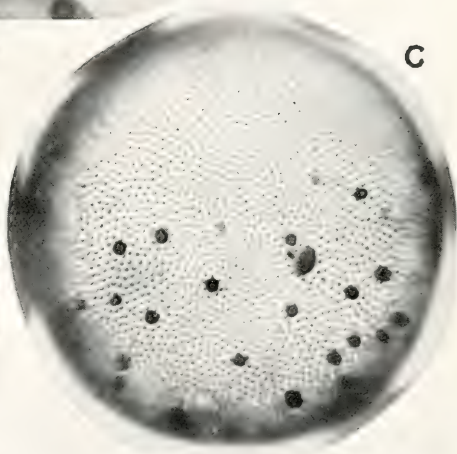


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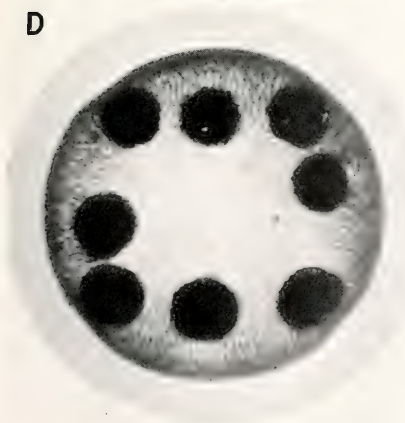


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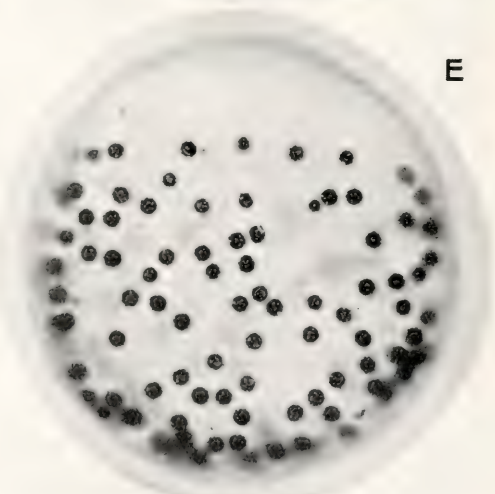
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D



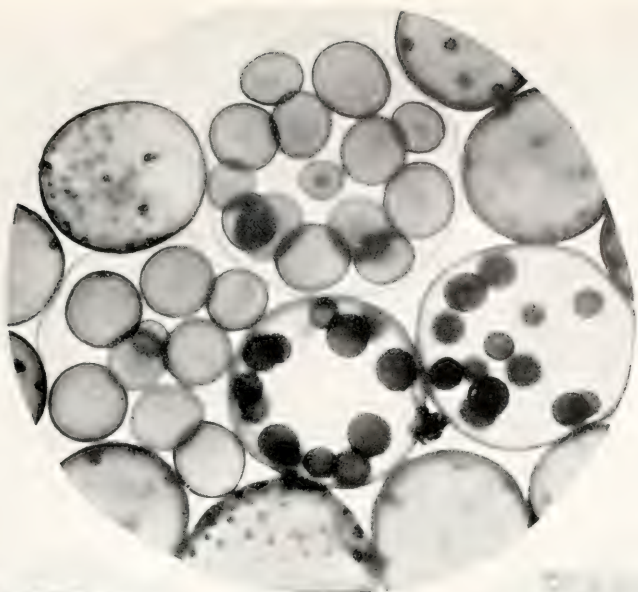
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SOUTH AFRICAN VOLVOX.







B

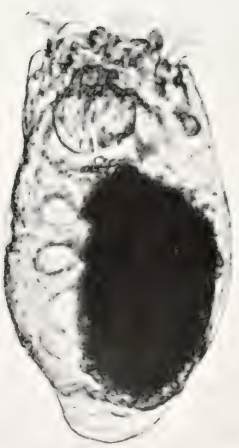


A

C

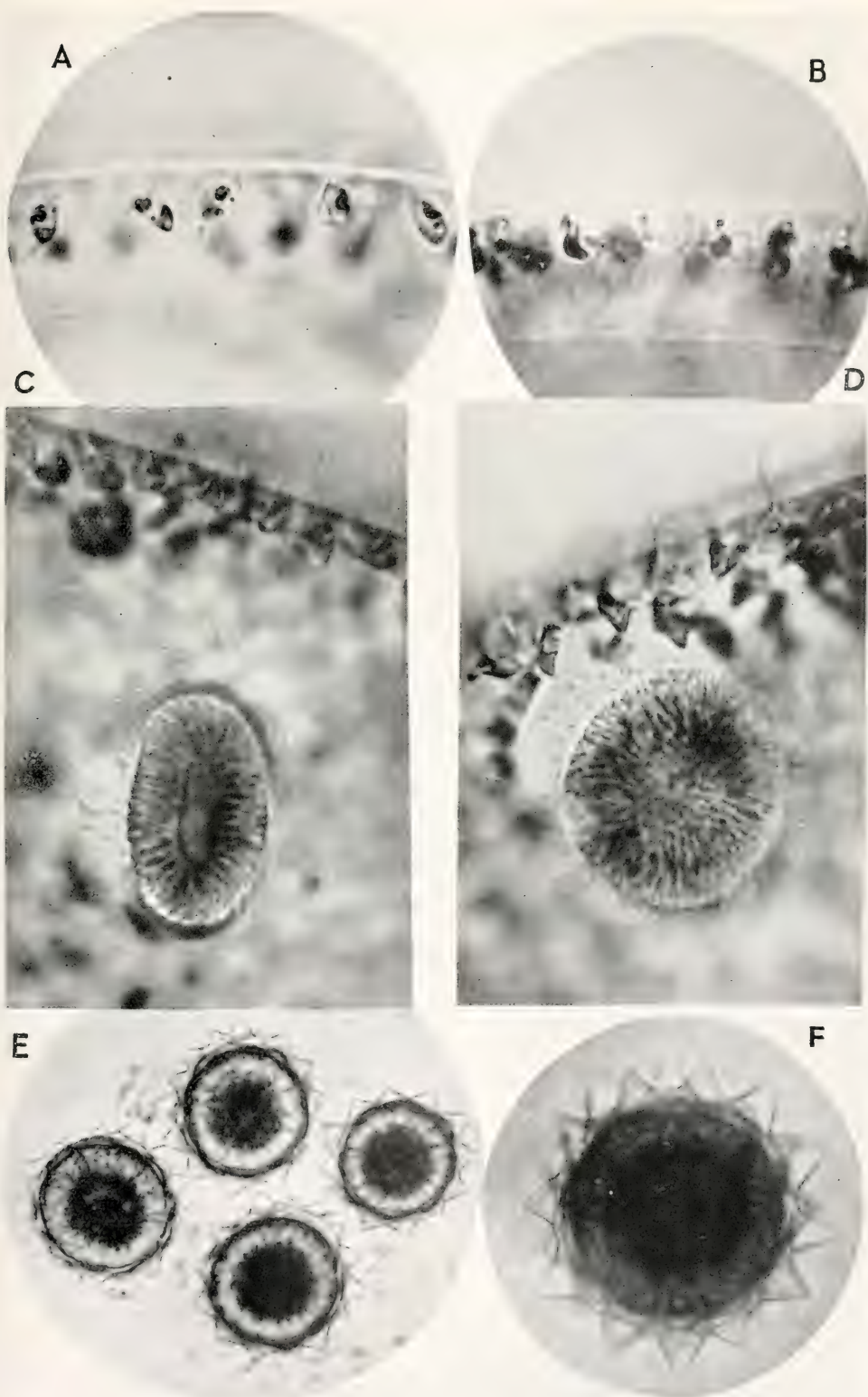


D



SOUTH AFRICAN VOLVOX.





SOUTH AFRICAN VOLVOX.

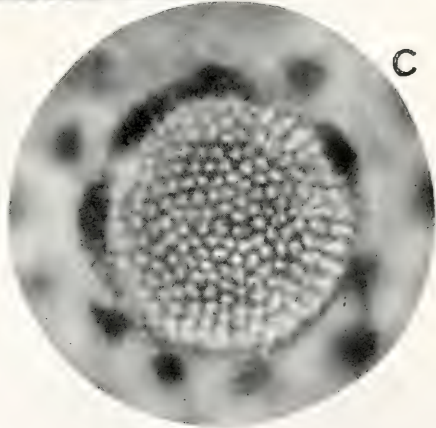




A



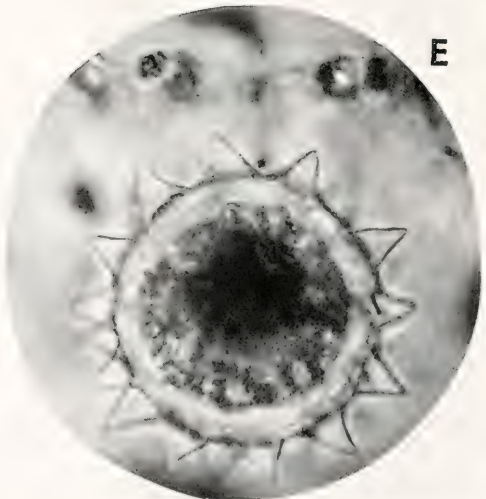
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D

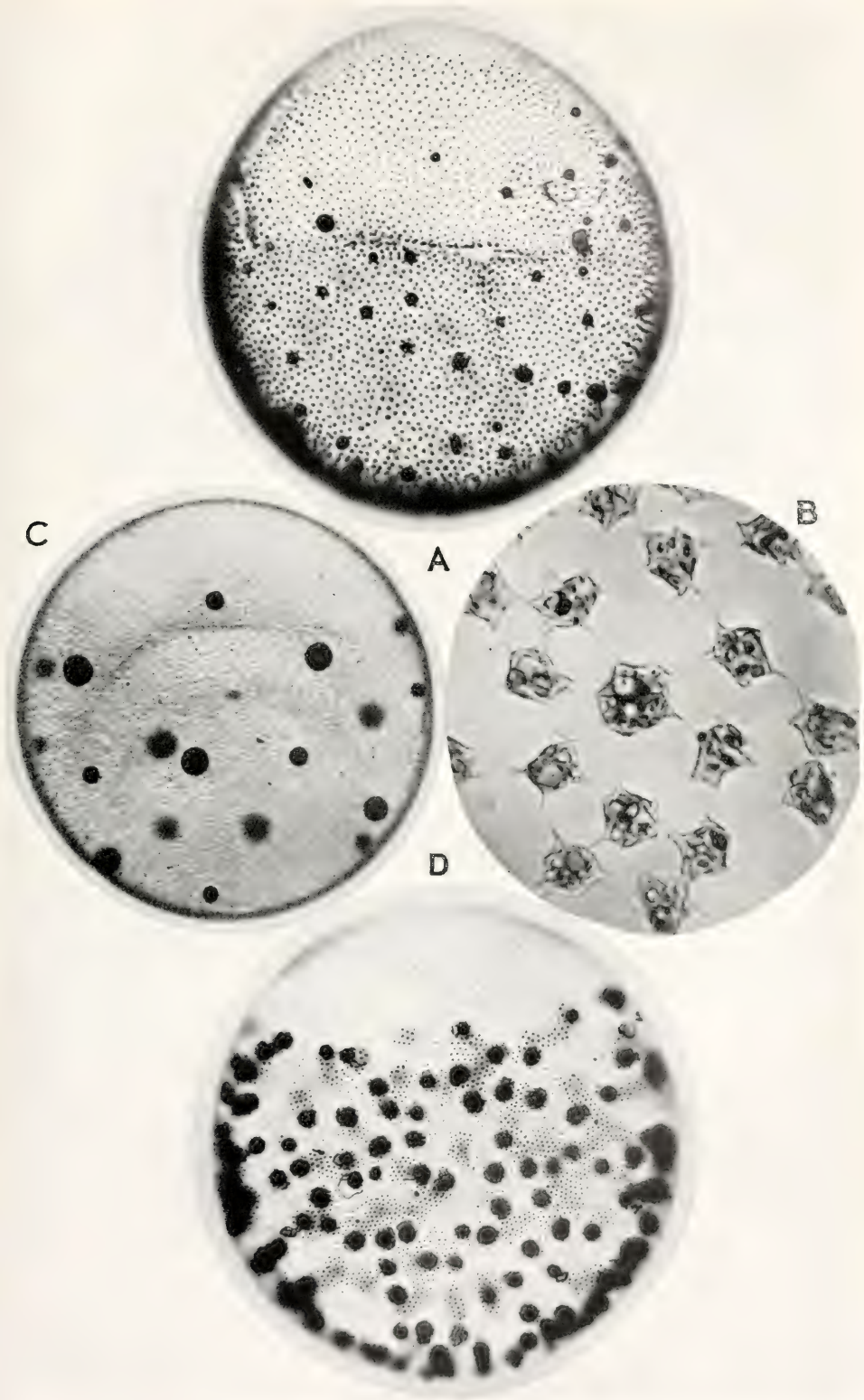


E

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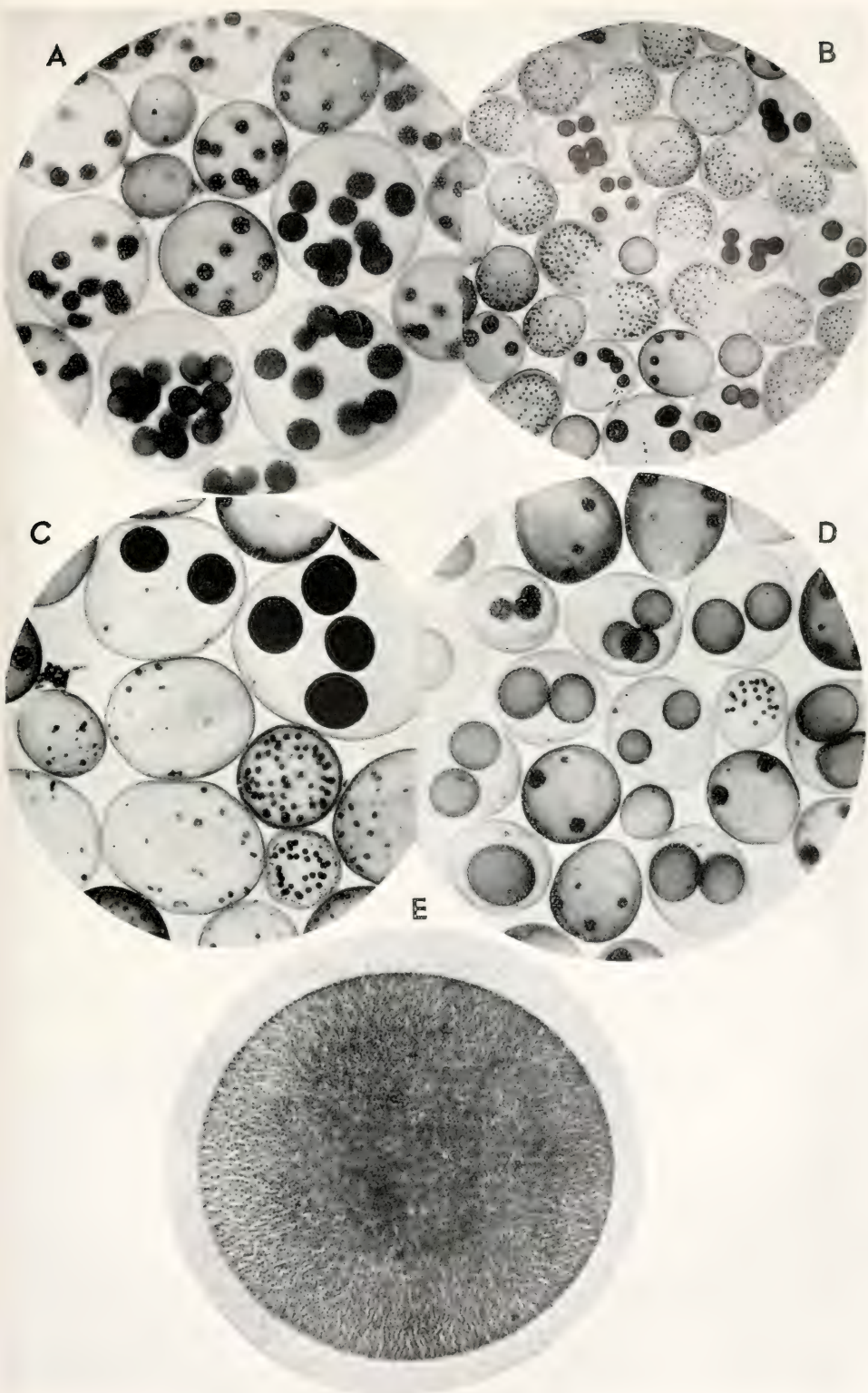






SOUTH AFRICAN VOLVOX.





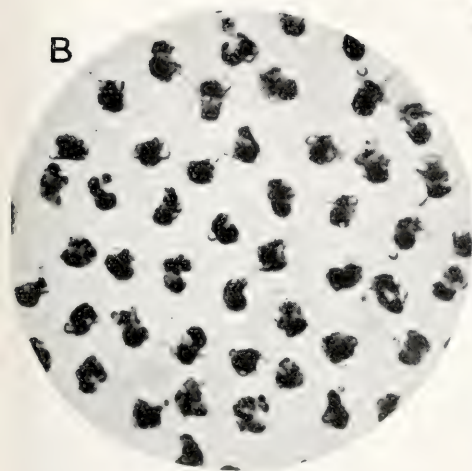
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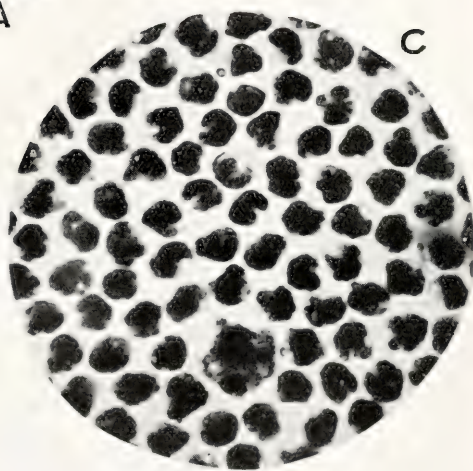




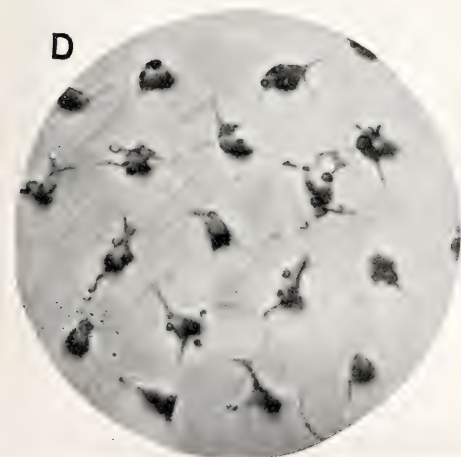
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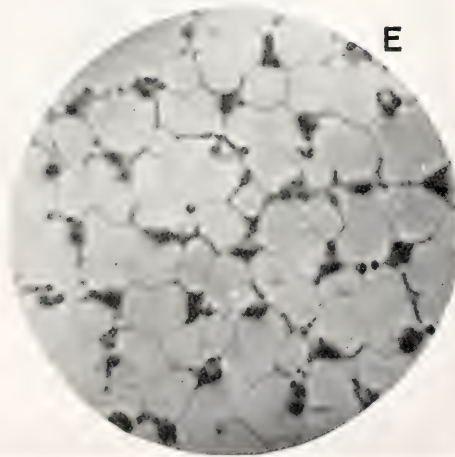
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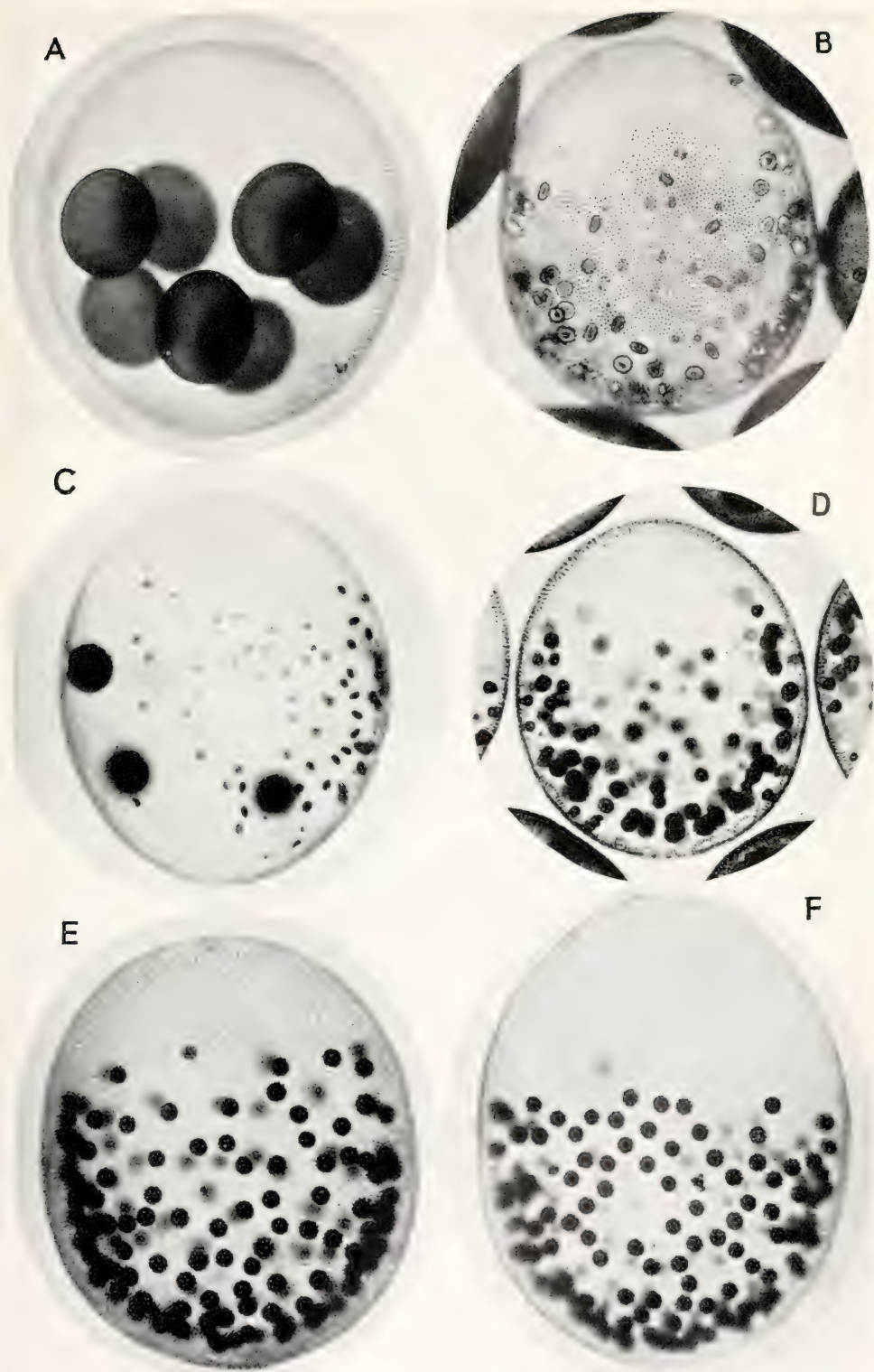
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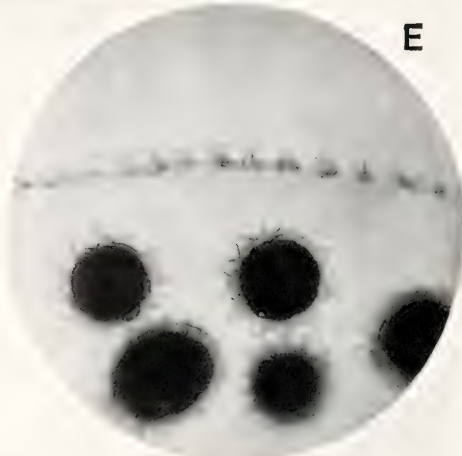
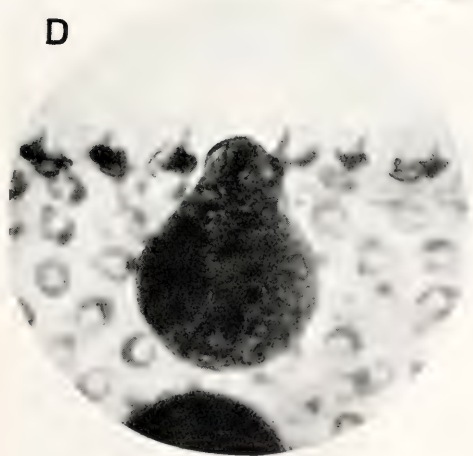
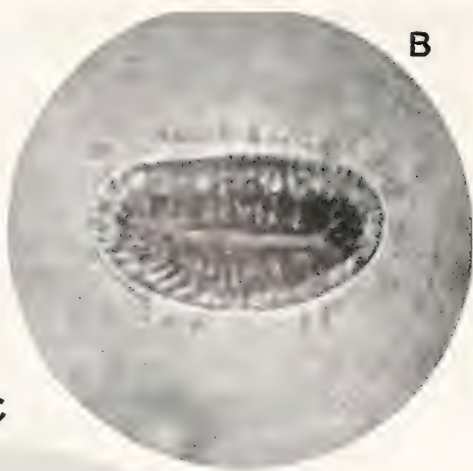
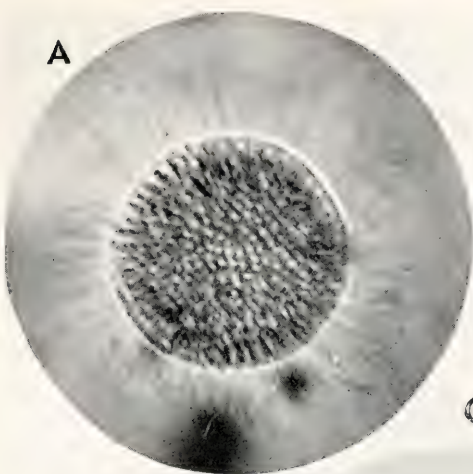
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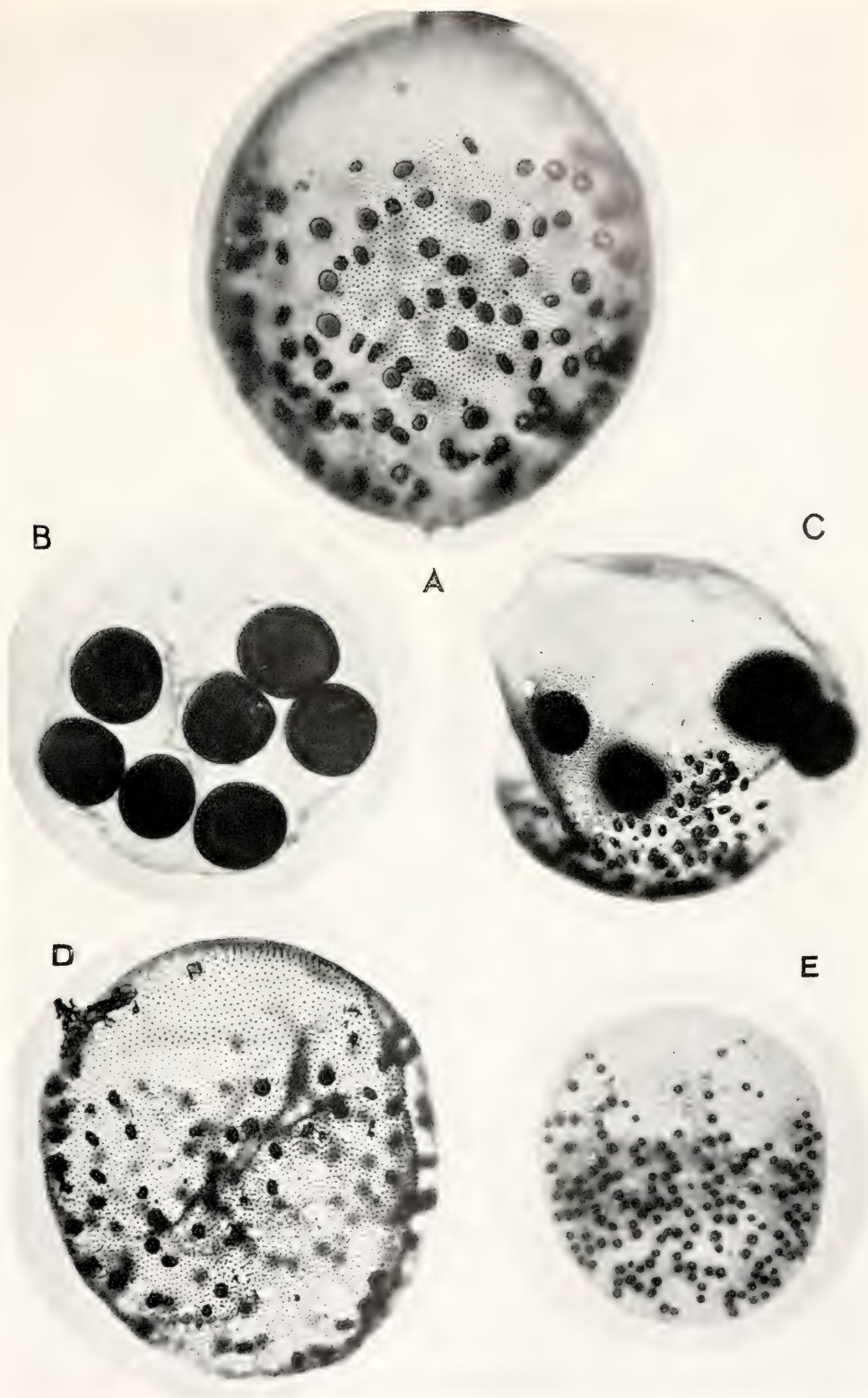




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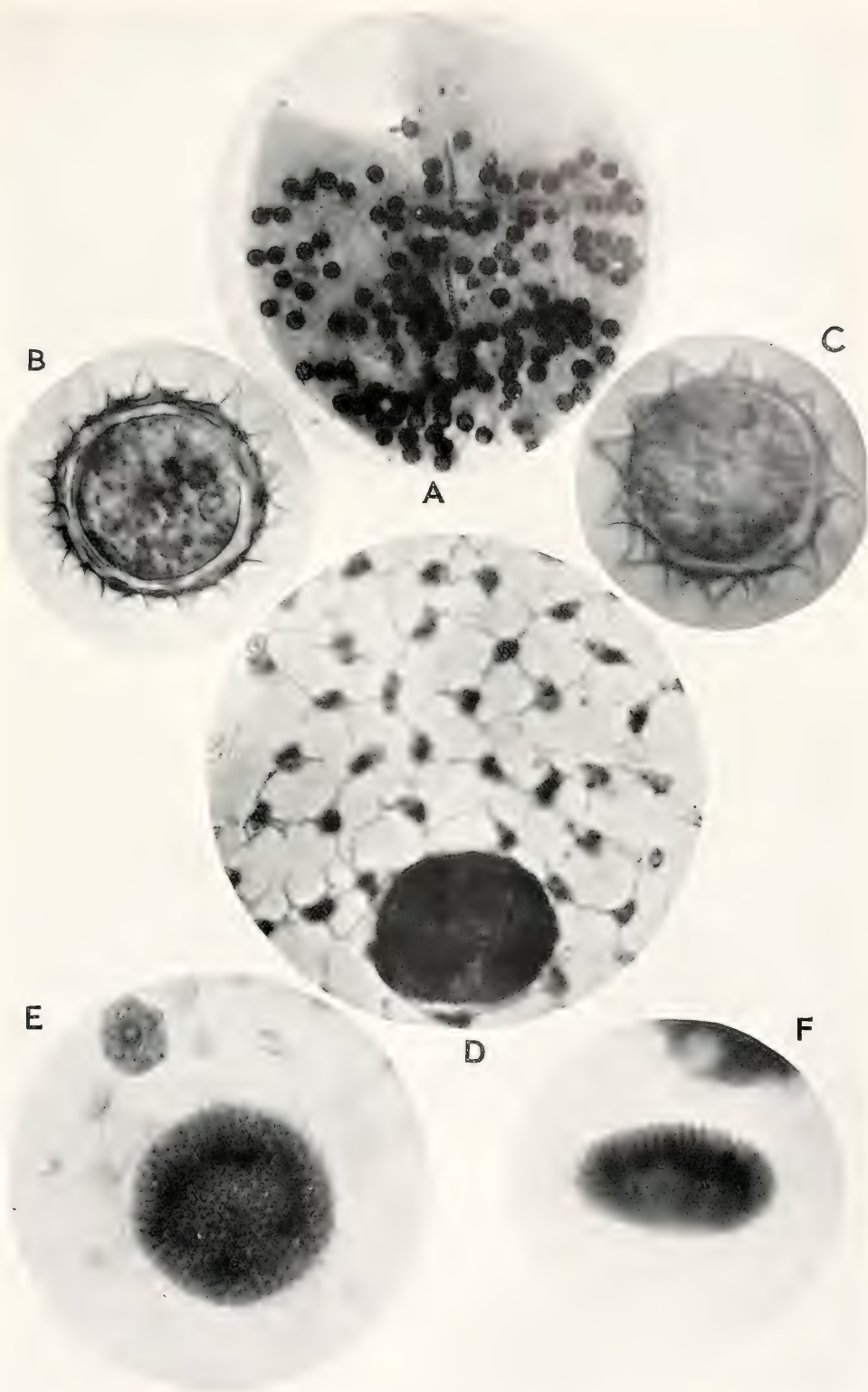






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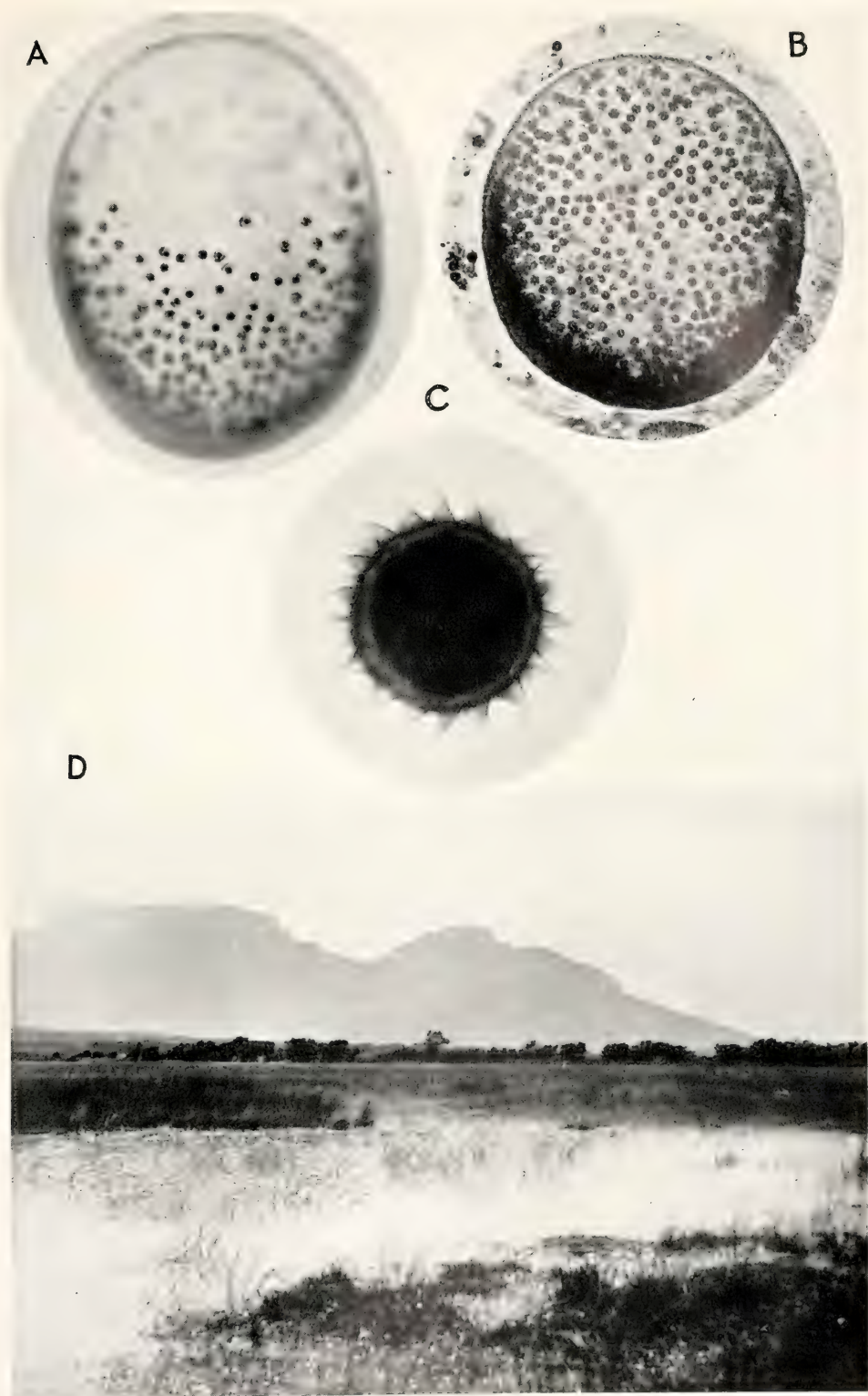




SOUTH AFRICAN VOLVOX.







SOUTH AFRICAN VOLVOX.



4. *Volvox and Associated Algae from Kimberley*.—By M. A. Pocock, Ph.D., F.L.S. With Field Notes by J. H. Power, F.Z.S., F.R.S.S. Africa.

(With Plates XXV–XXXVII and 7 Text-figures.)

CONTENTS.		PAGE
Part I. Introductory . . . . .		473
Part II. Description of the Species . . . . .		479
<i>Eudorina elegans</i> Ehrenb. . . . .		479
<i>Volvox gigas</i> sp. nov. . . . .		480
<i>Volvox africanus</i> G. S. West . . . . .		492
<i>Volvox Rousseletii</i> G. S. West forma <i>griquaensis</i> f. nov. . . . .		498
<i>Sphaerocystis Poweri</i> sp. nov. . . . .		501
<i>Kirchneriella africana</i> sp. nov. . . . .		506
Part III. Field Observations and Records . . . . .		509
Summary . . . . .		513
Discussion and Conclusion . . . . .		514
Bibliography . . . . .		515
Description of Plates . . . . .		517

PART I.—INTRODUCTORY.

TOWARDS the end of the year 1931, while examining pools in the neighbourhood of Kimberley for fresh-water crustacea, Mr. J. H. Power found *Volvox* in abundance in a small quarry pool. The material collected was sent, with the crustacea, to the South African Museum and handed to the writer for investigation. The *Volvox* proved to be a large form, apparently of the type of *Volvox Rousseletii* West, but as it was purely asexual an exact determination could not be made. A request for further material, however, resulted in a second collection made early in December, in which there was abundant sexual material of all ages, the sexual colonies if anything outnumbering the asexual. The provisional diagnosis made from the first material was in the main confirmed; but although obviously very closely allied to the material from Rietfontein (Rich and Pocock, 1932, p. 455), which may be regarded as typical, it yet differed from it in some details. It was thought, therefore, that it might be

instructive to watch its development, and this was fortunately made possible by having on the spot a keen and experienced collector in the person of Mr. Power.

When next visited, on the 22nd of December, the pool was completely dry, but this rainy season in the Kimberley district proved to be a somewhat abnormally prolonged one, characterised by a succession of distinct downpours separated from one another by several weeks of dry, hot weather. Consequently the various pools dried up completely and refilled several times during the summer. During the succeeding three months (January to April 1932) Mr. Power kept the first *Volvox* pool under frequent observation, visiting it at intervals of two or three days whenever it contained water, and the present paper is the result of his observations and collectings. Although a very incomplete record of the seasonal history of the pool, the results are instructive, especially when compared with the facts known about the behaviour of *Volvox* in other areas, and are particularly noteworthy as illustrating the extraordinarily rapid development of certain forms of *Volvox* in a region of intermittent summer rainfall, and the much greater rapidity of development under identical conditions found in some species than in others.

Meanwhile search for *Volvox* was continued in other local pools without success, until late in the season, when it was found in two more small pools, called Pools II and III respectively in this paper. All three pools are formed in quarries from which building material has been removed, and are therefore probably of comparatively recent origin. Pool I is in typical red Kimberley soil, a mixture of clay and very fine-grained sand, drying very hard; owing to the fineness of the particles it forms a thick suspension in the water, which is consequently opaque and of a deep reddish colour throughout the existence of the pool—very unlike the clear water characteristic of *Volvox* vleis on the Cape Flats. In Pool II, on the other hand, the water is clear, the sides and bottom of the pool being formed of broken stone, while Pool III is of yet a third type, since it is in limestone tufa, of which material the sides and bottom are composed. The water is muddy and has a higher lime-content than usual in the district.

A point which may possibly have some bearing on the behaviour of *Volvox* during its life-cycle, namely the Hydrogen-ion concentration of the water, has not so far been investigated. Keeping in mind the high day temperature, the rapid evaporation of the water, and the enormous quantity of animal life present, it is probable that the pH alters considerably and rapidly, and it is perhaps to this that we must

look for the explanation of a phenomenon already observed elsewhere, but as yet nowhere to such a marked extent as in these Kimberley pools, namely, the sudden and complete disappearance of *Volvox* which often occurs when the water reaches a certain degree of lowness, usually about 4 inches in depth, but long before the pool is nearly dry and while associated animal (mainly crustacean) and plant life continues unabated for some days longer. This disappearance is not heralded by any apparent falling off in numbers or development, but comes with remarkable suddenness, often apparently at the height of development of the strain. A very few colonies continue for a time, but the majority disappear completely in the course of a few hours. High temperature \* alone does not seem sufficient explanation, nor can the crustacea be entirely to blame.

To give an idea of the sequence of events it is necessary first to describe briefly the nature of the fauna and flora of the pool, or rather, of the plankton, as revealed by Mr. Power's collections; the attached algae, of which some at least certainly occur, were not collected. All collecting was done with a small net swept through the surface layers of the water, so that planktonic life alone, and at that only the larger species, was collected.

The fauna consisted almost entirely of crustaceans of various kinds, Streptocephalids being particularly abundant. It would be interesting to correlate the appearance and numbers of the various species with those of the associated algae, but that is not possible here. In addition, a few Protozoa were noted; Rotifers were scarce as compared with other *Volvox* inhabited pools, but in one collection a few individuals of *Proales parasita* were found in colonies of *V. Rousseletii*. The parasite never obtained a very great hold on the *Volvox*, however, probably owing to the brief duration of the pools.

As regards the flora, besides two species of *Volvox* in Pool I it consisted almost entirely of colonial forms belonging to the *Tetrasporales* or *Protococcales*, with some *Eudorina*, while in Pools II and III *Volvox* only was found, two species in Pool II, one only in Pool III, the latter being the form of *V. Rousseletii* which is common to all three pools. In the case of the two latter pools, however, too few collectings could be made to establish much beyond the fact of the occurrence in them of certain forms of *Volvox*.

\* A similar phenomenon was observed on the Cape Flats in November 1931, when such a sudden disappearance followed on a day of very great heat, when the water (3-4 inches deep) in the pool reached a temperature of over 32° C. at midday.



The common *Volvox* is undoubtedly very near to *V. Rousseletii* West; but since, as mentioned above, certain marked characteristics distinguish it from the typical form, it is described here as a form of that species to which the distinguishing regional name *Griquaensis* is applied. It develops very quickly and is associated in Pool I with a second species much slower in development. The young colonies of the latter were frequent in the third collecting and somewhat suggested *V. africanus* in appearance; but whereas *V. Rousseletii* was already in an advanced sexual phase this second species was obviously still very young, with numerous large but still undivided gonidia. In succeeding phases it never appeared in the first collectings. In the first phase the pool dried up before any further stages could be obtained, but, when next formed, the pool had a longer existence and more advanced stages of the species were obtained in the later collections. These proved truly startling—*V. Rousseletii*, previously regarded as an unusually large species of *Volvox*, was completely dwarfed by the maturing asexual colonies of the new species; the diameter of most of the colonies containing embryo colonies was well over 2 mm., while colonies of 3 mm. or over were not unusual. The first microphotograph (Plate XXV, A) shows the relative sizes well; in the centre are an average-sized male colony and an immature asexual one of *V. Rousseletii* forma *griquaensis*, with a young colony, such as was first observed, of the giant, and round these are four maturing colonies of the latter, with fully formed daughters and undivided gonidia. The group, as in the case of the other low-power photographs reproduced, was floating in water in a glass dish and not compressed by its own weight on a slide. When placed on the slide such colonies flatten out enormously, appearing among associated *V. Rousseletii* colonies as large, clear, nearly colourless circular patches.

It is considered that the name *Volvox gigas* can with justice be given to this magnificent species.\* No trace of sexual organs could be found in this material nor in the succeeding collection during this phase of the pool's existence; but during the next phase, from the third collecting onward, *Volvox gigas* became more and more abundant until on 16th March it was the dominant organism among the plants, showing all stages in sexual reproduction. Thus by repeated collections made at frequent intervals very rich material has been obtained and consequently as full a description can be given as is perhaps

\* A specific name in honour of its collector was barred by the previous existence of *Volvox Powersii* (= *Besseyosphaera Powersi* Shaw), Printz. See p. 492.

possible from the examination of preserved material only. Observation of living material is of course needed to fill in details of habit and general behaviour, such as reaction to light, and of some phases of development, as, for instance, certain stages in the development of the embryo colonies, and the mode of escape on maturity. As regards response to light, since the eyespots in the anterior part of the colony are particularly large and well developed, there is no doubt that this species, like the other members of the *Volvocinae*, is strongly phototactic.

Soon after the appearance of young colonies of *Volvox gigas* in the pool non-motile gelatinous colonial algae begin to be prominent in the phytoplankton. As development in the pool proceeds and the water grows lower, these increase enormously in amount, while the *Volvox* decreases, until finally it disappears altogether and the flora is composed entirely of these gelatinous forms. Thus during the existence of the pool there are several distinct stages, each characterised by the appearance or dominance of a different alga or group of algae: first, *Volvox Rousseletii* develops in enormous quantities, then *Volvox gigas* appears, and sometimes, but not always, becomes dominant; about the same time the other colonial algae begin to get numerous, subsequently increasing greatly, until finally they alone survive.

These colonial algae included at least four different forms, all of which at first appeared to belong to different genera. On further examination, however, three proved to be forms of one extremely polymorphic species which has been identified as belonging to the genus *Sphaerocystis* Chodat (1897*a*, p. 119). In its first mature form this is a striking and very beautiful alga, very unlike anything hitherto seen (Plate XXXVI, B). The colony is usually an almost perfect sphere with 16 or 32 (occasionally 8) ellipsoidal groups of large green spherical cells placed symmetrically within the periphery of the sphere. The regularity of the arrangement of these groups within the common envelope, the uniformity of the number and size of the cells composing the groups in any one colony, and their symmetrical spacing distinguish it from anything as yet described (Chodat, 1897*b*, p. 293, emphasises the *irregularity* often seen in his species, *Sph. Schroeteri*), and it is therefore regarded as a new species to which the name *Sphaerocystis Poweri*, in honour of its collector, is given (Plates XXXVI and XXXVII.)

But in addition to this striking spherical form other forms appear, and, since there are transition stages present, all evidently belong to

the same species. The second conspicuous form, which eventually becomes dominant, consists of irregularly rounded, lobed or elongated, sometimes branched masses composed of large numbers of rounded cells in a gelatinous matrix, very similar to a *Tetraspora*, but showing no signs of pseudocilia. As there has in the past been considerable difference of opinion as to whether similar masses found associated with *Sphaerocystis Schroeteri* were actually a phase in the life of that alga or a species of *Tetraspora* (West, W. & G. S., 1912, p. 413) it was particularly interesting to find the two forms here, linked up by every stage in transition from one to the other.

Finally, a third striking form, comparatively rare and only seen during fairly early stages of development of the pool, consists of botryoidal clusters of rounded aggregates of groups of very small cells, similar to very young spheres of the first stage. These have no firm exterior lamella to the gelatinous envelope, the presence of which cannot be detected until after treatment with some stain, e.g. iodine or methylene blue. When first seen such colonies suggested a *Dictyosphaerium* or *Westella* in general form, but no signs of connecting strands could be distinguished. It is apparently intermediate between the spherical form and the *Tetraspora*-like phase; the gelatinous envelope of a sphere in which the cells of the groups have already divided loses its firm outline, and the daughter spheres, instead of escaping separately, remain in contact with one another, without developing outer membranes. Continued division soon results in an amorphous gelatinous mass containing numberless cells such as is characteristic of the palmelloid *Tetraspora*-phase.

Obviously a study of *living* material of this very interesting and somewhat puzzling alga is highly desirable.

Mixed with the various forms of *Sphaerocystis* is yet one more arresting alga, a very large species of *Kirchneriella* Schmidle. It is characterised by the large size of the colonies, often over 2 mm., sometimes as much as 4 mm. long, and the great number of cells composing them. It is usually much less abundant than the *Tetraspora*-form of *Sphaerocystis* which it much resembles in general form and appearance; but in fairly early stages of the pool's development (e.g. 8th February, see Table I) it may far outnumber the latter, and is then usually associated with comparatively numerous colonies of the botryoidal form of that alga.

These gelatinous colonial algae can evidently thrive in quite shallow water in which the temperature at midday must be high, continuing to do so for some days after conditions have become

impossible for *Volvox*. Eventually, as the water dried they formed a compact gelatinous mass at one end of the pool. Further, if the pool refilled even after a very short period (in one case only three or four days) of dryness, *V. Rousseletii* developed again with great rapidity (*cf.* Phase 3), yet if rain refills it towards the end of a phase when the *Volvox* has already disappeared, but before the pool has quite dried up, this alga does not reappear. This is seen at the end of this same phase, when on 18th March light rain prolonged the life of the pool. Although collections were made for twelve days after that date, in all of which the non-motile algae were most abundant, only occasional colonies of *V. gigas* were found and no *V. Rousseletii*. This seems to indicate the need for at least a brief period of dryness to mature the oospores of the latter form of *Volvox* before they can germinate.

## PART II.—DESCRIPTION OF THE SPECIES.

### A. VOLVOCALES.

#### I. Genus EUDORINA Ehrenberg.

##### *Eudorina elegans* Ehrenb.

Coen..	.	.	.	53–215 $\mu$ $\times$ 62–258 $\mu$
Cell.	.	.	.	19 $\mu$
Coen. c. embryon.	.	.	.	366 $\times$ 430 $\mu$
Embryon.	.	.	.	44 $\times$ 53 $\mu$

Occasional, among *Volvox*, etc. in Pool I, particularly during the earlier stages.

Except for its somewhat unusually large size this material seems to conform to typical *E. elegans*. Mostly large 32-celled colonies, often with daughter colonies fully formed, were seen, small colonies being very rare. In some, all the 32 cells had formed daughter colonies; in others, several cells had remained undivided.

It is probable that this species is actually far more abundant than the number of colonies noted would indicate, since the collecting was done mainly for *Volvox* and not for the finer plankton.



## II. Genus VOLVOX (Linnaeus) Ehrenberg.

## Section MERRILLOSPHAERA (Shaw) Printz.

1. *Volvox gigas* sp. nov.

(Text-figures 1-3, Plates XXV-XXX.)

*Volvox maximus*, coenobiis asexualibus mixtisque sub-globosis, usque ad circa 3 mm. latis; cellulis rotundis, circa 1000-3000, sine connexionibus; coenobiis infantibus permultis usque ad ca. 82, plerumque 30-60, interdum cum numerosis oosporis mixtis; coenobiis prorsus sexualibus minoribus quam asexualibus vel mixtis; coenobiis masculis oviformibus usque ad circa 1 mm. latis, 1.3 mm. longis, vel rotundis, minoribus; antheridiis numerosis usque ad circa 600-700 in parte quarta anteriore absentibus, spermatozoidis longis, 16,32,64, vel 256,512 coalitis in globulis 18-22  $\mu$ , vel 40-49  $\mu$  latis; coenobiis femineis globosis usque ad 2.25 mm. latis, oosporis numerosis, globosis, membrana duplici, episporio levi, aliquanto crassi, endosporio tenue.

Coen. asex. et mix..	. 1615-2800 $\mu \times$ 1700-3135 $\mu$
Coen. masc. . . .	. 732-1141 $\mu \times$ 797-1292 $\mu$
Coen. masc. min. . .	. 246- ? $\mu \times$ 242- ? $\mu$
Coen. fem. . . . .	. 1679-2154 $\mu \times$ 1723-2206 $\mu$
Coen. infant. . . .	. 108-388 $\mu \times$ 129-431 $\mu$
Cell. veg. . . . .	. 26-84 $\mu$
Pplast. veg. . . .	. 9-13 $\mu$ ; Stigma, 3-4 $\mu$
Gonidium . . . . .	. 35-49 $\mu$
Glob. sperm. . . .	. 18-22 $\mu$ ; vel 40-49 $\mu$
Spermatozoid. . . .	. 2-4 $\mu \times$ 11-17 $\mu$ ; cilia, 14-19 $\mu$
Cell. num. . . . .	. 1000-3000
Coen. infant. num. .	. ad 82; pler. 30-60
Glob. sperm. num. .	. ad ca. 600 vel 700
Oospor. num. . . .	. ad ca. 300 vel 400 (?)

Found in Pool I only.

This remarkable member of the *Volvox* group is outstanding on account of: (1) its size, completely dwarfing the form of *V. Rousseletii*—a fairly large one—with which it is associated; (2) the large number of daughter colonies, as many as 82 having been counted in one coenobium, while 30 to 60 per coenobium, often associated with numerous oospores, are common; (3) the slow development; the



gonidia are quite clearly differentiated from the somatic cells at a very early stage, certainly very shortly after inversion of the embryo colony, and continue to enlarge with the somatic cells within the parent and after birth, but do not begin to divide until the colony has reached a large size, usually over 1 mm., when the gonidia may be as much as 44 to 49  $\mu$  in diameter; and (4) the structure and distribution of the sperm bundles; in the posterior part of the male colony all the cells become antheridium mother-cells, *i.e.* they are not mixed with somatic cells; the size of the antheridium mother-cell, and consequently the size of the resultant sperm bundle and the number of spermatozooids composing it, all vary greatly.

*Membranes and Cell Structure.*—The membranes (fig. 1) are similar in arrangement to those of *V. tertius* Meyer and *V. africanus* West. In the recently inverted embryo the polygonal (usually hexagonal) protoplasts are in contact, but begin at once to separate from one another. At birth and for some time after, treatment with methylene blue shows the cell membranes as more or less hexagonal in outline (fig. 1, B); as development proceeds and the cells become further apart, each protoplast is seen to be enclosed in a wide, lenticular membrane, which is in contact with the outer limiting membrane over a circular or elliptical area above the protoplast (fig. 1, A, D). The membranes of adjacent cells are at first in contact, but in adult colonies they may be completely isolated from one another (fig. 1, E, K). Even in this stage, however, it is sometimes possible to distinguish faint hexagonal markings on the outer membrane of the colony (fig. 1, J). The spaces between the cell membranes stain faintly purple, while the membranes themselves are deep reddish purple. The appearance after treatment with methylene blue, as seen in surface view at different focal depths, is shown in fig. 1, F–H, while J and K show corresponding views from an older colony.

In young colonies the peripheral gelatinous layer is wide, and more so in the posterior than in the anterior region of the colony, about 60 to 70  $\mu$  at the anterior, 70 to 80  $\mu$  at the posterior pole (fig. 1, A); as the colony gets older it becomes narrower and less regular (fig. 1, C), varying considerably in one and the same colony. It is bounded on the inside by a purple-staining membrane, similar to but more delicate than the outer membrane. The fluid filling the central hollow appears to be slightly mucilaginous, but shows no definite structure. The daughter colonies develop within the much enlarged gonidium walls, lying between the inner and outer membranes; hence, probably, the elongated shape of the young embryos (fig. 1, E).

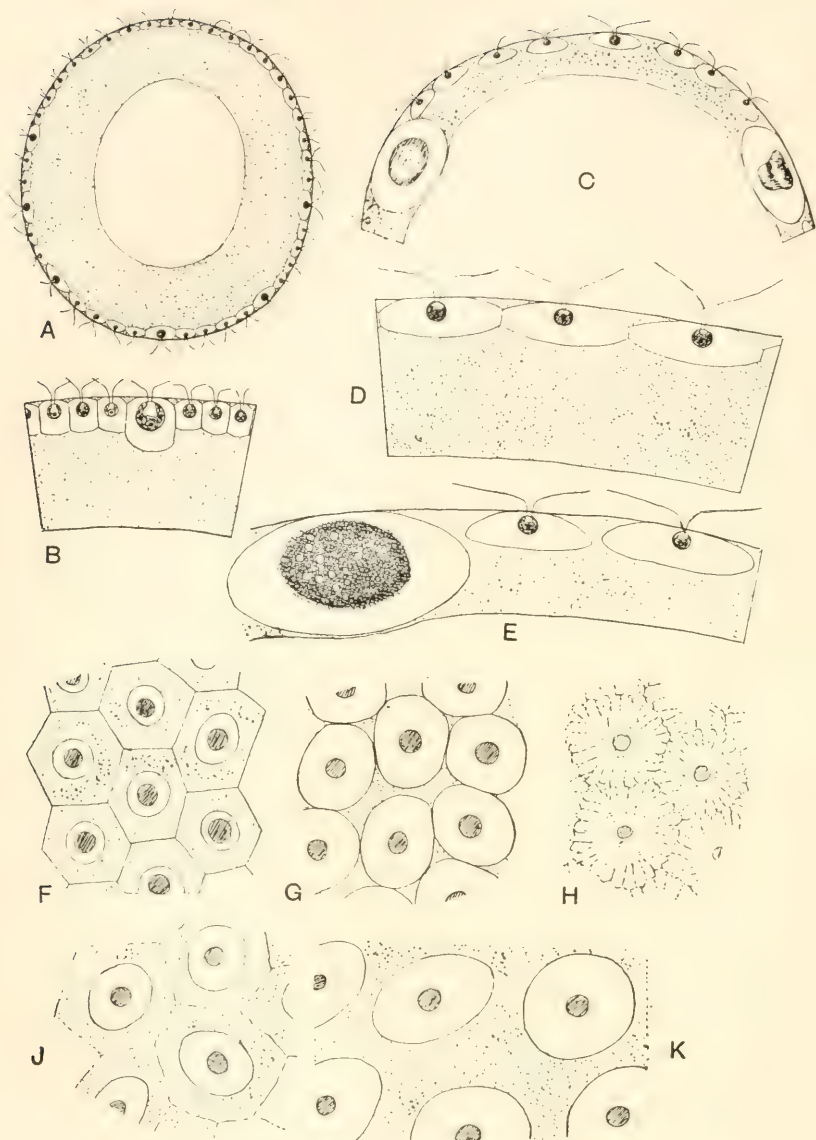


FIG. 1.—*Volvox gigas*, membranes.

A, Young asexual colony with undivided gonidia showing inner and other envelopes and membranes of individual cells; B, part of peripheral layer of very young colony at about time of birth; C, the same of a mature asexual colony, one embryo beginning to invert; D, E, portions of A and C respectively on a larger scale; F-K, cells in surface view; F, top, G, middle, and H, bottom, focus of cells from colony A; J, K, top and middle focus of cells from colony C.

A  $\times 40$ ; C  $\times 100$ ; B, D-K  $\times 200$ ; all approximately.

The somatic cells (fig. 2, A, B) are practically spherical, sometimes showing a very slight anterior projection; they lie below the surface membrane suspended in the non-staining vesicle enclosed by the lenticular cell membrane. The extensive lobed chloroplast lines the whole wall except for a small area at the apex; there is a large basal pyrenoid from which several smaller pyrenoids later separate off, and a central nucleus; with methylene blue the whole protoplast stains blue, the nucleus and pyrenoids more deeply than the cytoplasm. In the anterior part of the colony each cell contains a large lenticular orange-red eyespot (3 to 4  $\mu$  in diameter), which, as in all other colonial members of the *Volvocinae* as yet examined, occupies a definitely orientated position in the cell, *i.e.* it lies on that side of the cell farthest from the anterior pole. The eyespot is usually rather low down, about midway in the cell (fig. 2, A).

The cilia are inserted separately, diverging slightly before they reach the surface membrane. No indication whatever has been seen of protoplasmic connections in mature coenobia, although in colonies of *V. Rousseletii* in the same material they showed clearly. In young unborn daughters, however, here, as in *V. africanus*, occasionally a connection may be seen between adjacent cells. Such connections are rare and at the best of times obscure, at any rate in preserved material (but see later, in connection with inversion).

*Reproduction.*—The reproductive cells are variously distributed; a coenobium may produce only gonidia which develop into embryo colonies (Plate XXVI, C, D, E), only male or female organs (Plate XXV, B 1 and 2), or all three. As a rule, however, the sexes are separated, sperm bundles rarely occurring except in exclusively male coenobia, although mixed colonies producing daughter colonies and oospheres are common (in one case over 70 embryos and about 43 oospheres were counted in a single colony), and reach a large size (Plate XXVI, B, and Plate XXX, B). Purely female colonies, on the other hand, are little larger than the male colonies, but usually rounder in shape. The four types of colonies, *i.e.* asexual, male, female, and mixed, and their relative shapes and sizes, are well illustrated in the group figured on Plate XXV, D. In this group, too, a few very young colonies are included.

(a) *Asexual.*—As already stated, the gonidia are differentiated early, but undergo a prolonged period of enlargement before division begins (*cf.* Plate XXVI, A). Colonies of over 1 mm. diameter in which the gonidia show no sign of division are often seen.

*Structure and Development of the Gonidium.*—When young the

gonidium is distinguished from the somatic cells by its larger size and more numerous pyrenoids; the apex of the chloroplast is lobed, so that the colourless anterior area appears more or less star-shaped

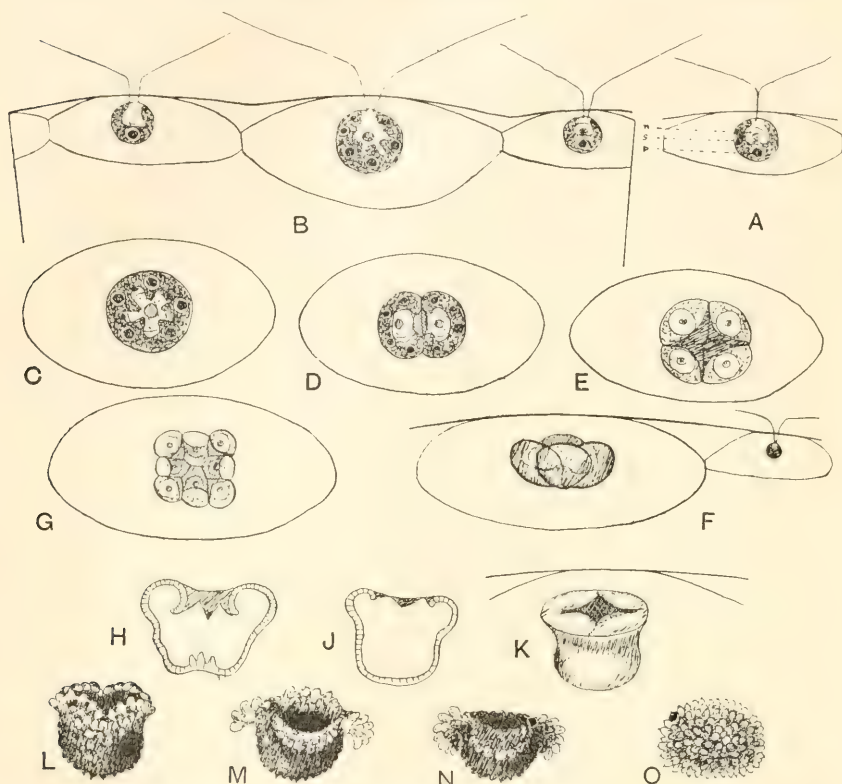


FIG. 2.—*Volvox gigas*.

A, Somatic cell from anterior pole; B, young gonidium and two somatic cells; C–O, development of the embryo; C, gonidium viewed from above; D, first division; E, F, four-celled stage seen from above and in side view; G, eight-celled stage; H–O, inversion of fully formed embryo; H and J, preparatory stages in optical section; K, general view; L–N, actual inversion in process; O, inversion complete, cilia appearing (L–O semi-diagrammatic).

A, B  $\times 500$  ca.; C–F  $\times 250$  ca.; H–O  $\times 350$  ca.

when seen from above (fig. 2, C). The cilia are lost early in the period of enlargement.

As is the case throughout the group, the first two divisions of the gonidium are longitudinal, in two radial planes at right angles to one another. The separation of the apices of the resultant cells is apparent even in the 2-celled stage (fig. 2, D), while the hollowing to form a



bowl-shaped structure is well defined in the 4- and 8-celled stages (fig. 2, E-G), becoming more and more pronounced as development proceeds. Once division has started it proceeds rapidly to completion, so far as could be ascertained following the scheme of division already described by Janet (1923, p. 109 *et seq.*, Plates VII to XVII) for *Volvox aureus* (*Janetosphaera aurea*); as in that species, the number of cells is comparatively small, despite the much greater size of *V. gigas*. Usually the number of cells is about 1000 ( $2^{10}=1024$ ), *i.e.* there are probably at least 10 successive divisions in normal embryos, and not more than 12, since the highest number of cells counted was about 3000 per coenobium.

*Inversion.*—Completion of cell division is followed by inversion of the embryo, resulting in the characteristic football-shaped daughter colony lying between the inner and outer membranes of the parent. In proportion to the number of embryos, the number of inversion figures seen in the material was extraordinarily small. This may be due to the fact that the process of inversion is a rapid one, or in part at any rate to the time of collecting, since the evidence in other species points to an optimum time for inversion about midday (Pocock, *seq.* p. 579). Inversion figures are commoner in some tubes than in others, though never very abundant. In spite of their comparative rarity, however, sufficient were seen to indicate the method of inversion which, as was to be expected, is a simple one, on the whole following the lines described for *V. tertius* Meyer by Kuschakewitsch (1922 and 1931),\* but in some ways more like that seen in sperm bundles of *V. capensis*.

\* Kuschakewitsch (1931, p. 328) states that the stages in inversion in *V. aureus* are so like those in *V. tertius* that a separate description for the former species was not necessary in his short paper. Janet (1923, p. 127, and pl. xviii) agrees with Kuschakewitsch, giving a single description for the process in the two species. Zimmermann (1925, p. 51), however, working with *V. aureus*, found considerable difference in detail in that species from the description given by Kuschakewitsch for *V. tertius*. Thanks to the kindness of Mr. Scourfield, samples of both *V. aureus* and *V. tertius* from Europe were available for comparison. These contain a few good inversion figures of which those in *V. aureus* include an early stage and the stages figured by Zimmermann as fig. 2, *g* and *h*, while in *V. tertius* stages corresponding to Kuschakewitsch, Taf. 20, B and E, and Janet, pl. xviii, C and D, were seen. Hence it seems probable that the descriptions and figures given by Kuschakewitsch and Janet must be regarded as applying to *V. tertius* only, while those given by Zimmermann are correct for *V. aureus*.

The fundamental difference in the two methods is that in the *V. tertius* type of inversion actual inversion starts by the lip of the phialopore turning outwards, while in *V. aureus* inversion begins behind the lip, which remains doubled inwards until a late stage, when it finally straightens out. A comparison of fig. 2, H-N, with fig. 5, B-F, will make this clear, since in *V. africanus* inversion is of a similar type to that in *V. aureus*.



A colony with undivided gonidia and developing embryos, including several in various stages of inversion, is shown in fig. B, Plate XXVI. The earliest stage seen (fig. 2, H) shows a widening 4-sided phialopore with 4-lobed lip, depressed and curled inwards, while the whole embryo shows some denting and distortion. In the next stage (fig. 2, J, K) the denting disappears, a slight constriction forms, and the lip begins to straighten out and rise. The phialopore continues to widen and the lobes turn outwards, becoming very distinct in the process; the cells at the edge are as a consequence in a state of tension, slightly separated from one another, and at this stage protoplasmic connections between the cells could be clearly seen (fig. 2, L, and Plate XXVII, A). These connections continue to show distinctly in the lobes as they fold back (fig. 2, M, and Plate XXVII, B, C). Characteristic "hat" stages follow (fig. 2, N, Plate XXVI, F, and Plate XXVII, D), and finally the edges of the phialoporic lobes meet and inversion is complete (Plate XXVII, E). At first the phialoporic side is flatter than the anterior pole, the ends of the elongated cells are rounded and separated from one another, and the very short developing cilia are visible (fig. 2, O, and Plate XXVII, F). The cilia lengthen rapidly, the cells alter in shape, becoming shorter, wider, and more compact, and the common envelope is formed (Plate XXVII, G); enlargement follows, and soon the gonidia are distinguishable from the somatic cells (Plate XXX, D).

The whole process of inversion is very like that observed in the germ colony formed on germination of the oospore of *Volvox Rousseletii* (cf. succeeding paper, p. 622); there, on completion of cell division the hollow globoid lies freely in a fairly wide vesicle much as does the young embryo of *V. gigas*, which, owing to the absence of intercellular protoplasmic strands, has no connection with the neighbouring somatic cells. The surrounding vesicle in the latter shows clearly in several of the microphotographs, e.g. Plate XXVII, C, D. This type of inversion would appear to be the primitive one characteristic of the simpler multicellular members of the *Volvocales*, in which the cell-number is several hundreds, but in general not more than 1000 to 2000.

A very interesting point emerged from the study of the inversion figures in this species. In his description of *V. tertius*, Meyer (1896, p. 200) states that although in the adult coenobium there are no protoplasmic connections between neighbouring cells, yet in living unborn embryo colonies such connections are readily visible. In both *V. gigas* and *V. africanus* protoplasmic connections can occasionally be seen

in embryo colonies before escape, but are entirely absent in the adult. At certain stages of inversion of the embryo in *V. gigas*, as described above, relatively stout protoplasmic connections between the cells became obvious in those parts of the embryo which are being stretched, and are certainly present throughout, although owing to the small size of the embryo and the close packing of the cells, except at the edges, they are not distinguishable. Now it must be remembered that the cells of the young embryo are not enclosed in a common membrane, but lie in close contact with one another. During inversion the cells act in concert with one another, but each is at the same time altering its shape and must to some extent act independently; while some are being compressed, others are in a state of great tension, tending to separate from one another. Obviously, since the globoid inverts as a whole, the connection between the component cells must be very intimate. It would appear that this is obtained by the presence of protoplasmic connecting strands, which therefore play an important rôle in the process of inversion, on completion of which they become functionless and are withdrawn, one only surviving here and there to a later stage in development. A further advance in complexity of structure is reached by those species which retain the protoplasmic connections throughout their life, *e.g.* *V. aureus*, while the members of the *globator* group have progressed yet a step further, since in these the connections develop as the colonies mature, reaching their maximum thickness when the reproductive cells are developing.

*Development of the Embryo subsequent to Inversion.*—The embryos are very small at the time of inversion (*e.g.*  $58 \times 66 \mu$ ,  $71 \times 53 \mu$ ) and enlarge considerably before birth (Plate XXVI, E). The component cells very soon begin to separate from one another, enlarging as they do so, while the gonidia now become very distinct from the somatic cells (Plate XXVI, E, and Plate XXX, D), their diameter at this stage being nearly double that of the latter; for example, in an embryo measuring  $77 \times 87 \mu$  the vegetative cells measured 3 to  $4 \mu$ , the gonidia 5 to  $6 \mu$ . As the embryo develops the proportion between the two types of cells remains approximately constant, until the somatic cells reach their maximum size, after which the gonidia still continue to grow until finally they are three times the diameter of the vegetative cells, or even more. Young oospheres are considerably smaller and increase in size more slowly, while the majority of the antheridium mother-cells do not grow much larger than the somatic cells until late in development (Plate XXVIII, C), although in some male colonies a few here and there enlarge similarly to the gonidia

(Plate XXVIII, A, B). The relative sizes of recently inverted and mature embryo colonies can be seen in Plate XXVI, E.

In addition to the typical ellipsoidal embryos composed of over a thousand cells there are often scattered among them others, usually rounded, composed of far fewer cells, in some cases as few as 64, but more often 128, 256, etc.; in these the majority of the cells enlarge proportionately more than in typical embryos, *e.g.* in one such colony, already free, measuring  $58\ \mu$  in diameter and composed of 128 cells, the majority of the cells measured  $10\ \mu$ , while a few at one end were smaller. Such "dwarf" colonies appear to be male colonies in which nearly all the cells function as antheridium mother-cells; the development of the sperm bundles, however, does not take place until after escape, and such small males are rare compared with the larger egg-shaped male colonies. The small colony shown in Plate XXV, C, contains young male colonies of this type and a few oospheres.

(b) *Sexual*.—(1) The male reproductive cells are nearly always found in exclusively male colonies, which are slightly smaller than the purely female colonies and which often become markedly egg-shaped as the sperm bundles develop (Plate XXV, B), or more rarely they may be such rounded dwarf colonies as are described above. Occasionally, however, sperm bundles have been found in female or mixed colonies, where one or two sperm bundles were scattered among the developing oospheres. As, however, such bundles are small and easily mistaken at low powers of magnification for oospheres just beginning to enlarge, it is quite possible that they may be of more common occurrence than would appear to be the case.

In the male colonies all the cells in the posterior half become antheridium mother-cells (Plate XXIX, A), a small anterior portion remains somatic, while between the two lies a zone where male initials and somatic cells are mixed (Plate XXVIII, C). Thus some three-quarters or more of the total number of cells in the male colony may develop into sperm bundles.

The antheridium mother-cell varies enormously in size—it may divide on reaching a diameter of  $18$  to  $20\ \mu$ , or division may be delayed until it is more than double that size, *i.e.* as large or nearly so as a mature gonidium. The number of divisions undergone depends on the initial size of the cell; most often it is 5, resulting in a bundle of 32 sperms, but bundles of 16 and 64 occur, while in many male colonies scattered among these smaller sperm bundles are others very much larger, containing a much greater number of spermatozooids—256, 512, or possibly even more. The latter are not unlike sperm bundles of

*V. Rousseletti*, in which closure has not been complete and which have not yet undergone subsequent compression (fig. 3, H, J, and Plate XXIX, E). In side view such bundles, like the smaller ones, are bowl-shaped, almost globular, but flattened at the open side. Thus in one and the same colony sperm bundles of several different sizes may occur (Plates XXIX, A, C, and XXX, A).

Stages in the development of sperm bundles are shown in fig. 3. Division of the antheridium mother-cell (fig. 3, A, B) follows the usual lines, resulting in the formation of a more or less rounded hollow bowl or globe according to the number of divisions undergone; where the divisions are few the resultant structure is more open and bowl-shaped, or, even in the case of the smallest bundles, saucer-shaped, while the very large type is almost globular (fig. 3, C). On completion of cell division inversion takes place; although few stages could be made out, sufficient were seen to indicate the type of inversion. In the case of the smaller bundles it is similar to that seen in *Eudorina*, while in the larger, many-celled bundles it is naturally rather more elaborate, approaching that seen in the case of the asexually formed embryos. Fig. 3, D, shows a medium-sized bundle in which the phialopore is opening preparatory to inversion, while fig. 3, E, shows a recently inverted small bundle with elongating cilia. Fig. 3, F and G, show optical sections of bundles of 64 and 128 spermatozooids respectively, while the largest-sized bundles are shown in different views in fig. 3, H and J. An early stage in the development of such a bundle is shown in Plate XXIX, fig. B, in which the second cell division is not quite complete; the separation of the cell apices is particularly clear, while the surrounding vesicle is faintly discernible. The adjoining microphotograph (E) shows the appearance of the mature bundle.

Examples of male colonies are illustrated on Plate XXVIII. Of the four male colonies depicted, one (C) contains only small and medium-sized sperm bundles, while the other three all contain a number of the largest sized as well. These appear in the photographs as very dark, rounded bodies. Of the smaller bundles many are in early stages of division, others are inverting. Colonies A, B and C are of the characteristic egg-shape; D is more nearly spherical. Plate XXIX, figs. A, C, and D, show portions of male colonies further enlarged to show details of structure and development of sperm bundles of various sizes.

The spermatozooids (fig. 3, K) are found in great numbers swarming on or within the peripheral layer of colonies containing oospheres



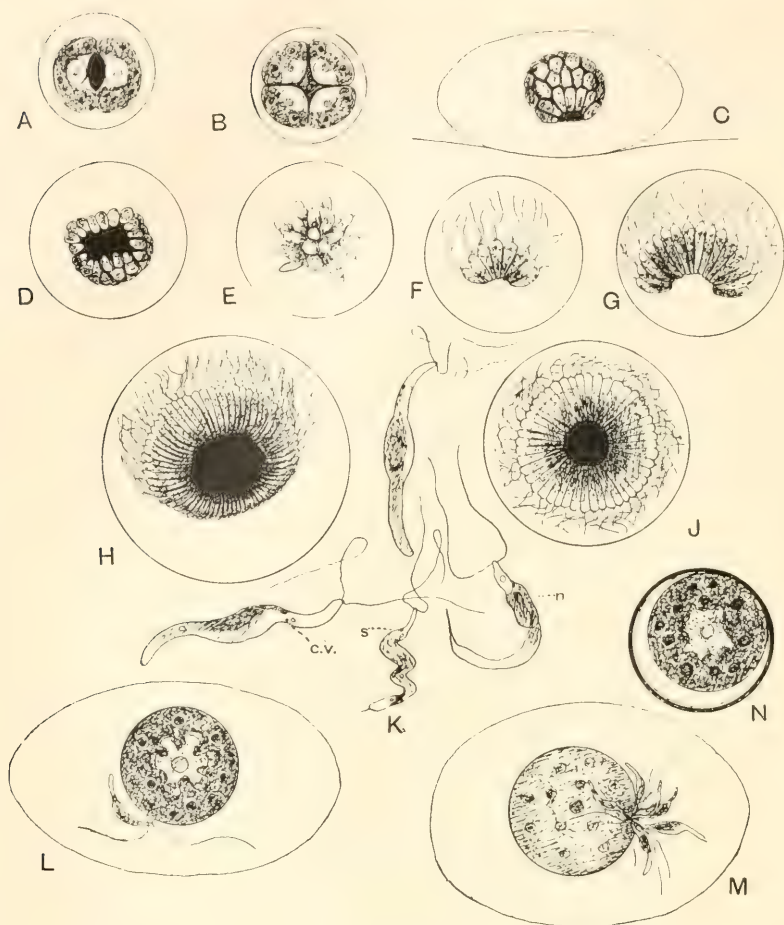


FIG. 3.—*Volvox gigas*. A–E, development of Androgonidium.

A, two-celled, and B, four-celled stage; C, cell division complete; D, bundle inverting (phialoporic view); E, inversion complete, cilia lengthening; F, G, optical sections of bundles of 32 and 128 spermatozooids respectively; H, largest-sized bundle (512 spermatozooids) viewed somewhat obliquely from below; J, phialoporic view, optical section; K, spermatozooids found swarming in female colony; L, M, spermatozooids swarming round oospores; N, ripe oospore.

s, eyespot; n, nucleus; c.v., contractive vacuole.

K  $\times 2000$ ; other figures  $\times 500$ ; all approximately.

(Plate XXX, C, D). They are long ( $11\text{--}17\ \mu$ ) and of rather distinctive form; as a rule there appears to be a central wider region ( $3\text{--}4\ \mu$ ) with an elongated nucleus and narrower anterior and posterior



portions. The colourless beak ends in a blunt point, the cilia, usually a little longer than the spermatozoid itself (14–19  $\mu$ ), being inserted at opposite sides of the apex and directed sideways and forwards, not backwards as in the *globator* and *aureus* types; in this respect they resemble the spermatozooids of *Eudorina elegans*. At the point of insertion is a refractive granule. At the apex of the chloroplast and near the base of the beak is a small red eyespot and adjacent to it are two contractile vacuoles. Most often only one vacuole could be distinguished, hence their periodicity is probably more or less alternating. The narrow posterior part may be prolonged into a delicate point or it may be rounded; probably the posterior process may be withdrawn or prolonged at will during the movement of the spermatozoid, as is the case in *Eudorina*. From the contorted shape of many of the spermatozooids the movement is evidently a combined amoeboid and ciliary one. In addition to the normal spermatozooids numerous long-drawn out, structureless ones, particularly common in older colonies, had evidently died before the material was fixed (Plate XXX, C). In developing and mature sperm bundles starch is present, but none could be detected in the free spermatozooids. They are rather longer than usual in *Volvox*.

(2) The *female reproductive cells* develop directly into oospheres; at first these can be distinguished from neighbouring somatic cells only by the presence of more numerous pyrenoids, but the size continues to increase and the cilia are soon lost; mature oospheres vary a good deal in size, and are practically spherical in shape. Spermatozooids swarming round the oospheres are common (fig. 3, L, M).

The oospores are comparatively small (31–44  $\mu$ ), with smooth fairly thick exospore, within which, when ripe, the protoplast, enclosed in the delicate endospore, lies somewhat eccentrically (fig. 3, N; Plate XXX, C). When ripe they are reddish gold in colour—even in preserved material the large colonies with ripe oospores glitter with a golden sheen when viewed by reflected light. The number per colony is large, certainly several hundred, but probably not so great as the number of androgonidia in the male colonies. In mixed colonies the number varies enormously. Purely female colonies are in general smaller than the mixed ones, which attain nearly, if not quite, as great a size as the purely asexual ones (Plate XXV, D).

From the above description it will be obvious that *Volvox gigas* is a very distinctive, if somewhat primitive, species. The only form as yet recorded which approaches it is that described by Powers

(1907, p. 123) \* without name, as a "second form" of *Volvox*, from Nebraska. Subsequently Shaw (1916, p. 253) named it *Besseyosphaera Powersi* (= *Volvox Powersii* Printz, p. 59), the asexual colonies alone having been observed by Powers; apparently, since there are no further references to it in the literature, it has never again been recorded. It resembles the present species in (1) the great size of the colonies, often over 2 mm. and up to 2.5 mm. in diameter, and (2) the large number of daughter colonies, up to 78 being recorded. Further, judging from Powers' remarks it is slow in development. But, according to Shaw, the gonidia are not differentiated until after birth, and on this feature, combined with the absence of protoplasmic connecting strands, Shaw founded his new genus *Besseyosphaera*, which he regarded as intermediate between *Pleodorina* Shaw and *Volvox*.

Powers found the asexual colonies in a pond which was deeper than those in which *Volvox* usually occurs in Nebraska, and "found nothing resembling it" subsequently (Powers, 1908, p. 142). It seems possible that on a fuller examination it might prove to be identical with the Kimberley material described here as *Volvox gigas*. On the existing descriptions, however, it must be regarded as distinct. The resemblance of *V. gigas* to *Pleodorina* is certainly very remote; it is unmistakably much more nearly allied to *Volvox* than to *Pleodorina*, and seems to be a somewhat primitive form belonging to the section *Merrillosphaera* (according to Printz, genus according to Shaw).

Powers' photographs of other species of *Volvox* are so excellent that it is most unfortunate that he apparently published none of either this "second form" described in his first paper or of another outstanding species which he named *Volvox perglobator* and which closely resembles *V. Rousseletii* G. S. West.

The field observations given below (pp. 38 to 39) show how much slower in development *V. gigas* is than the associated *V. Rousseletii*.

## 2. *Volvox africanus* G. S. West (1910, p. 102, and 1918, p. 1).

(Text-figures 4 and 5, Plates XXX (fig. E) to XXXIII.)

Asexual colonies in all stages of development. No sexual colonies seen. Mature colonies large, over 1 mm. in length and nearly 1 mm. in width.

\* Unfortunately, Powers' original paper has not been available for reference; the substance has had to be gathered from references by other authors, particularly Shaw, and from Powers' own remarks in his subsequent paper (1908, p. 142).

Daughter colonies most often eight, arranged symmetrically in pairs, two pairs nearly equatorial, two nearer the posterior pole. The pair most nearly equatorial develops first, other pairs develop successively in order of their position, the most posterior developing last. Anterior pairs may have inverted and may contain developing gonidia before cell division in the posterior pair is complete. In some of the young coenobia the four central daughters were in early stages of division, while two pairs of undivided gonidia still in the stage of enlargement and  $35\ \mu$  and  $28\ \mu$  respectively in diameter occupied positions near the posterior end. Sometimes fewer, rarely more than eight, daughters develop; colonies with six, five or even fewer embryos were observed, while in one case there were nine, an extra one having developed near the equatorial plane. If an odd number develops, an abortive gonidium representing the missing member of the pair is usually, but not invariably, traceable.

The protoplasts of the somatic cells are rounded, without protoplasmic connections. In the developing embryo, however, intercellular protoplasmic strands are present until inversion is achieved, and occasionally one here and there survives and can be seen in the unborn embryo.

Coen. asex. . . . .	366-926 $\mu \times$ 387-1077 $\mu$
Embryo, inverting . . . .	75 $\times$ 90 $\mu$
Embryo, mature . . . . .	366 $\times$ 451 $\mu$
Gonidium, mature . . . . .	28-44 $\mu$
Gonidium in inverting embryo.	9-16 $\mu$
Somatic cell . . . . .	16-20 $\mu$
Somatic protoplast. . . .	5-7 $\mu$
No. of cells . . . . .	3000-7000

Found in Pool II only; rare, associated with *V. Rousseletii*.

This species was found in Pool II late in the season, after the last rains. It was present in very small quantities mixed with numerous very large, vigorous, but young asexual colonies of *V. Rousseletii*; not a single sexual colony of either species could be found, although the pool was visited several times until it was completely dry. It is to be hoped that next season it will be possible to keep this pool under observation for a longer period and that sexual material will be obtained so that the description of the species may be amplified, since West did not obtain satisfactory male material, and even Shaw, in his extended description (1923, p. 197), does not describe the male reproductive organs fully, and differs from West in some details.

The species is very distinctive, in some ways the most beautiful of all the African species of *Volvox* (Plate XXXI, A-D). Its fairly large ellipsoidal colonies with symmetrically arranged pairs of embryo colonies are quite unmistakable, even in the absence of sexual reproductive organs. The two poles are usually equally rounded, though occasionally one, usually the anterior, but sometimes the posterior pole, may become slightly broader than the other.

The Kimberley material includes colonies considerably larger than any yet described, and, in spite of its rarity, there was sufficient material to add several details to our knowledge of the species. It is therefore described here in some detail.

*Membranes.*—Diagrams showing the form of the membranes in this species have already been published (Rich and Pocock, *loc. cit.*,

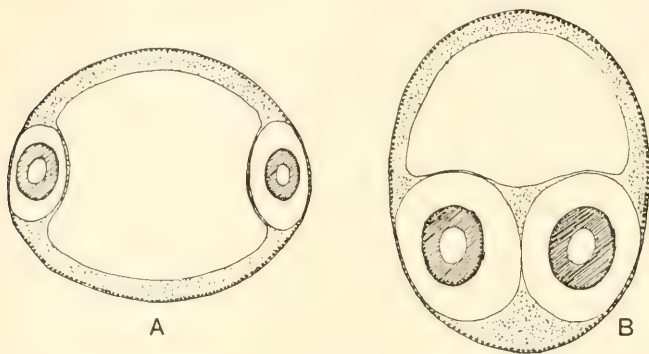


FIG. 4.—*V. africanus*, treated with dilute methylene blue to show the membranes.

A, Young colony, optical section, polar view; B, older colony after escape of equatorial embryos. Side view.  $\times$  about 45.

p. 432, fig. 1, B). As, however, no detailed description of them was given they are briefly described here.

As in *Volvox gigas* and *Volvox tertius*, each cell is enclosed in a lenticular membrane which is united with the outer common envelope above the protoplast. The adjacent cell membranes are often separated from one another, but never to so great an extent as in the mature colonies of *V. gigas*.

The inner limiting membrane is fairly distinct and regular in young coenobia, the developing embryos in their surrounding vesicles lying in the peripheral layer between the inner and outer membranes (fig. 4, A). As the embryos develop, however, they grow very large and push aside the inner membrane, displacing it considerably



(fig. 4, B). The microphotograph reproduced in Plate XXXI, C, shows a mature colony from which the equatorial embryos have already escaped, the respective pores of escape of two of them showing clearly at the two sides near the equator. The posterior embryos, of which three are seen, have continued to grow after the others had escaped and nearly fill the posterior half of the parent. The membranes surrounding the embryo colonies show clearly, and the inner membrane of the parent can just be distinguished above the latter and in the anterior part of the coenobium. The colony had been treated with methylene blue and was photographed free on the slide to avoid undue distortion. The same colony, unstained, appears in the group (Plate XXXI, A) just above. The position of the embryos between the two membranes in *V. africanus*, as in *V. gigas*, probably accounts for the lateral compression and elongated shape often characteristic of young embryos; but in the former species they attain a very much greater size in proportion to the parent than in the latter, and soon become wider than the peripheral zone, hence the great distortion of the inner membrane.

*Inversion of Embryo Colonies.*—Inversion figures are not abundant in the material, but in proportion to the number of embryo coenobia examined they are far more numerous than in *V. gigas*, and what there are are excellent, particularly in the iodine-fixed material, showing no appreciable distortion. Probably the process is a much lengthier and more complicated one than in that species; this was to be expected from the fact that the cells are far more numerous in proportion to the size, and further, that the gonidia are already large before inversion takes place. On the completion of cell division, the gonidia, particularly the two equatorial pairs, are large and project far inwards from the peripheral layer of somatic cells. In one inverting embryo the size of the gonidia varied from 9  $\mu$  at the posterior (phialoporic) end to 16  $\mu$  at the equator.

So far as could be made out from the available material the stages in inversion are as follows:—

There is a well-marked preparatory stage characterised by the infolding of the four lobes of the phialopore and more or less extensive denting such as is seen in *V. Rousseletii* and *V. capensis*, etc. (fig. 5, A, B). At this stage the vesicle sometimes has a curious dumb-bell shaped appearance. The phialopore enlarges considerably without the lip becoming straightened out, and a constriction appears somewhere between the equatorial and the posterior gonidia; the upper (outermost) part, still double, folds back (fig. 5, C), and the “hat”



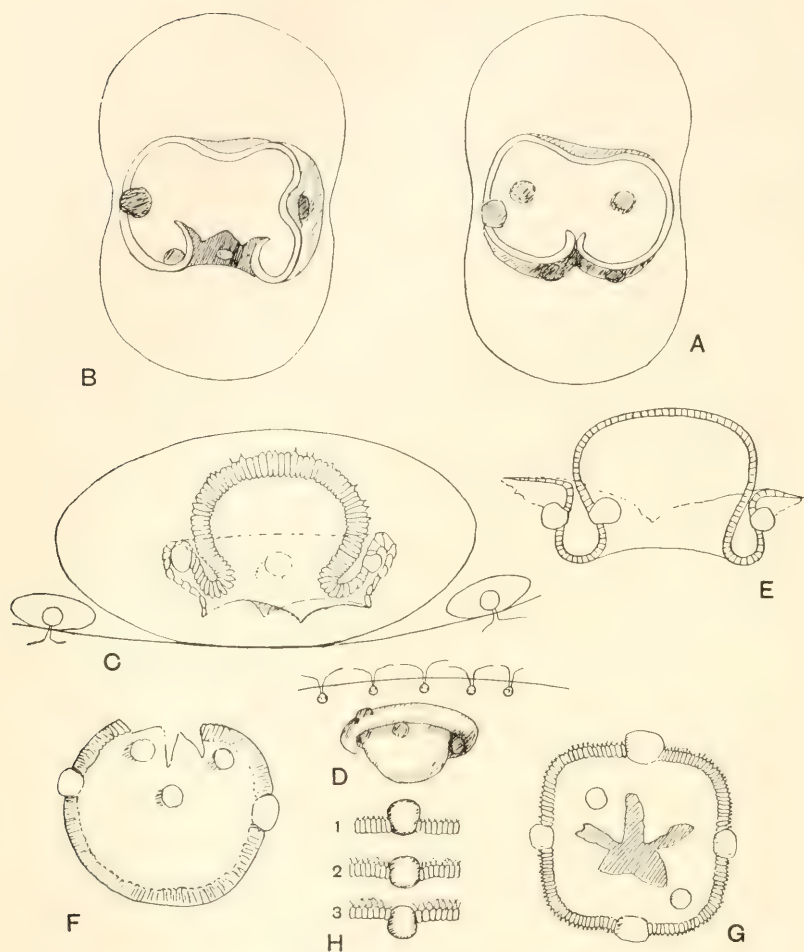


FIG. 5.—*V. africanus*. Inversion of the embryo (diagrammatic).

A, B, Preparatory stages, showing denting and incurving of lip of phialopore, and position of gonidia before inversion; C, early stage of inversion, infolded lip curving back; D, side view of the same colony, slightly tilted, on a smaller scale; E, a later stage, the infolded portion opening out; F, G, inversion nearly complete, but phialopore not yet closed; F, as seen from the side, G from above; three pairs of gonidia of different sizes can be seen projecting from the surface of the inverted embryo; H, detail of relation of gonidium to the somatic cells (1) directly after inversion, (2) later when in-sinking of the gonidium has begun, and (3) in final position.

D  $\times 150$ ; others  $\times 260$ , approximately.

stage begins (fig. 5, D, Plate XXXIII, A, B). In Plate XXXIII, in A a gonidium shows at the angle of the fold on the right, B is of the same coenobium seen with slightly different focus, while C shows the phialoporic view; the four-sided opening is clear, with projecting gonidia visible on two sides, while a larger one shows in the fold at the top on the right.

The infolded lip now begins to straighten out, forming a wide fringe round the centre of the embryo, nearly filling up the lenticular vesicle. Plate XXXII, E, shows this stage as seen from above, fig. 5, E, and Plate XXXII, D, as seen from the side. Again, the four-angled opening and large gonidia can be seen. The other member of this pair of embryos, nearly at the same stage of development, is shown in the microphotograph C, Plate XXXII.

In the next stage found inversion was almost complete and the phialopore beginning to close (fig. 5, F, G, and Plate XXXIII, E). The opening is irregularly lobed, the four lobes being of somewhat different sizes. The embryo is now a very striking and peculiar looking object; in polar view it is four-sided, with rounded angles. From the centres of the four sides the relatively huge gonidia project, the narrower inner end being sunk in the peripheral layer of cells, while the broad end now projects outside the embryo (Plate XXX, D, and Plate XXXIII, D). The position of the gonidia is readjusted by the gradual insinking of the gonidia until the anterior ends are on a level with those of the somatic cells (fig. 5, H, 1 to 3, and Plate XXXIII, F).

In one large colony (Plate XXXII, A and B) the two posterior daughters were inverting (Plate XXXII, C and D), of the next pair one was in the stage of projecting gonidia (Plate XXX, D, and Plate XXXIII, F), while in the other the gonidia had already sunk into their final position. In the four equatorial embryos the central gonidia had already started dividing, while the posterior pairs were still enlarging.

Microphotographs showing several corresponding stages, notably "hats" and recently inverted daughters with projecting gonidia, are given by Powers (1908, pl. xxiv, figs. 25, 28 to 32) for *Volvox Weismannia* (*Merrillospheera Carteri* (Stein) Shaw, var. *Weismannia*).

Good as these few inversion figures in *V. africanus* are, a study of living material is essential for a full account of the process of inversion in this species; it seems, on the whole, to approximate to the type of inversion described for *V. aureus* by Zimmermann (1925, p. 51; see note above, p. 485), but even these few stages in preserved material

are sufficient to show that there are several differences in detail, and the whole process of inversion is complicated by the large size of the gonidia.

The two new records for *V. africanus*, i.e. from the Linyanti River (Rich and Pocock, *loc. cit.*, p. 441) and the present one from Kimberley, are interesting, extending its range in Africa considerably. It is evidently widespread in the warmer regions of the world, having now been recorded from Albert Nyanza, Tanganyika, Rhodesia, and Kimberley in Africa, the Philippines, and S. India (Iyengar, 1933). So far, it seems to be nowhere abundant. Possibly, like *V. gigas*, it is slow in developing and undergoes a prolonged asexual phase followed by a relatively brief period of sexual activity. It will be especially interesting if it proves possible to study it in life, since so far, apparently, all descriptions, even Shaw's, have been made from preserved material only.

The Kimberley material is outstanding both from its larger size and the very regular development of four pairs of embryos; in the earlier collectings two and four have been the usual numbers of embryos, with six occasionally, although Shaw, 1923, p. 197, found in the Manila material a small proportion of colonies containing eight.

#### Section EU-VOLVOX Printz.

#### 3. *Volvox Rousseletii* G. S. West.

Forma *griquaensis* f. nov.

(Plates XXXIV to XXXV, A to E.)

Forma coenobiis sexualibus majoribus quam in forma typica, antheridiis oosporisque permultis.

Coen. asex.	.	.	.	710–1809 $\mu \times$ 904–1900 $\mu$
Coen. masc.	.	.	.	471–1443 $\mu \times$ 559–1550 $\mu$
Coen. fem.	.	.	.	600–1464 $\mu \times$ 644–1636 $\mu$
Coen. infant.	.	.	.	? –494 $\mu \times$ ? –517 $\mu$
Cell. veg.	.	.	.	8–13 $\mu$
Pplast. veg.	.	.	.	4–6 $\mu$
Glob. sperm.	.	.	.	35–41 $\mu \times$ 18–22 $\mu$
Oospor.	.	.	.	40–53 $\mu$
Oospor. sine sp..	.	.	.	35–40 $\mu$
Spin. long.	.	.	.	5–9 $\mu$
Cell. num.	.	.	.	ad ca. 43,000

Coen. infant. num. . . .	4-19
Glob. sperm. num. . . .	?-800
Oospor. num. . . . .	?-655
Coen. juvenil. . . . .	215-322 $\mu \times 258-366 \mu$
Coen. juvenil. embryon. .	129-215 $\mu \times 139-240 \mu$
Coen. juvenil. cell. num. .	ca. 330-418

Found in all stages in Pool I ; asexual only in Pools II and III.

This form combines characteristics of various forms of *Volvox Rousseletii* and its allies—the very large number of sperm globoids (Plate XXXV, A, B) suggests the material from Ussangu (West, 1918, p. 2), while in the unusually high number of oospores (Plate XXXV, D, E), often several hundreds, it resembles *Volvox amboensis* (Rich and Pocock, *loc. cit.*, p. 462); on the other hand, the sexual colonies, although on the whole larger than usual, do not reach anything like the size attained in the Ovamboland material, and very large asexual colonies are on the whole rare and slightly below the maximum size observed in the Rietfontein cultures.

It is typically dioecious, the male colonies (Plate XXXV, A, B, D) being better developed and more numerous than in any other form as yet examined; but an occasional sperm-globoid in otherwise female colonies is not unusual, this again suggesting a resemblance to *V. amboensis*. The oospores (Plate XXXV, F) are usually slightly smaller than in the Rietfontein material, with shorter spines, and are intermediate between that form and the form from the Kaokoveld (forma *kaokoensis*, Rich and Pocock, p. 460).

The asexual colonies are often markedly egg-shaped, particularly in the purely asexual material from Pools II and III which is included here, although sexual colonies are lacking. In the more egg-shaped coenobia the embryo colonies are nearer the posterior pole than usual, even the most anterior being definitely posterior to the equator. In purely asexual material the number of embryo colonies is high, usually over eight, as many as 19 having been counted, while 12 to 14 are common. During the sexual phases the asexual colonies are smaller and contain fewer daughters, usually under eight (Plate XXXIV, A, B).

The Juvenile form (Plate XXXIV, G, E) was collected in great numbers on one occasion, and is similar to that of *V. Rousseletii* and of *V. capensis*, but is slightly larger, composed of rather more cells, and usually produces two or three embryos (Plate XXXIV, C), while as many as five were seen.

The most striking characteristic of the form, however, is the great rapidity of development; this is brought out clearly in the field notes given below (p. 509), but the most marked and at the same time most complete record may be summarised here :—

The pool had dried up completely by 24th February 1932. Three days later heavy thunder-showers during the night of Saturday, 27th February, filled the pool once more. The following Wednesday (2nd March) a fine crop of Juveniles, with a few very young second- or third-generation colonies, was obtained. Two days later (*i.e.* in less than a week after the rain) among large asexual colonies containing up to 10 embryos were a number of sexual colonies, mostly young (Plate XXXIV, A), while by 7th March it had reached the height of the sexual phase, and a week later had almost disappeared, although the pool did not dry up until some time later.

Obviously it is a form well adapted to the local conditions, which are such that any pools formed can have only a short existence, although they may form several times during a single season. From observations made on the Cape Flats during last year one is forced to the conclusion that a relatively high temperature is beneficial to both the rate and degree of development, provided the water does not fall below a certain depth.

The behaviour of *Volvox* in the neighbourhood of Kimberley is very suggestive of the notes made by Powers (1908, p. 141) in Nebraska, where conditions appear to be very similar to those prevailing in some parts of Africa where there is a summer rainfall.

*V. Rousseletii* was found in all stages in Pool I each time it filled, and after the last rainfall in asexual stages only in Pools II and III. The identification of the latter is therefore only provisional; at present, however, there is no reason to regard the latter material as at all distinct from that from Pool I. Other pools in the neighbourhood were examined for *Volvox* but so far without success.



## B. TETRASPORALES, PALMELLACEAE.

## Genus SPHAEROCYSTIS Chodat.\*

*Sphaerocystis Poweri*, sp. nov.

(Fig. 6, and Plates XXXVI, XXXVII.)

Familiae formae pervariantes, aut (1) familiae plerumque conspicuo perfecte globosae in tegumento gelatinoso hyalino vel sub-flavo involutae; cellulis 32, raro 8 vel 16, regulariter ad peripheriam dispositis, plerumque omnibus extemplo partitis in sub-familiis similis ellipsoideis 8- (raro 4-), vel 16-, vel 32-cellularum compositis, ad peripheriam aequabilitissime dispositis; aut (2) familiae magnae amorphae, interdum fere rotundae, plerumque elongatae irregularitae, fere teretes; cellulis permultis, rotundatis, parvis, in tegumento gelatinoso hyalino; zoosporis utrobique parvis vel paullum majoribus, ovatis, interdum leviter obliquis; aut raro (3) familiae botryoidae, sub-familiis pluribus, cellulis minimis in tegumento gelatinoso hyalino irregulariter lobato consociatibus.

1. Fam. glob. diam. . . . . 140–1615  $\mu$   
 Cell. diam. . . . . 6–16  $\mu$ ; plerumque, 16–20  $\mu$   
 Subfam. . . . . ?–215  $\mu \times 151 \mu \times 108 \mu$   
 Zoospor. . . . . 4–5  $\mu \times 7$ –9  $\mu$ ; vel 8–9  $\mu \times 10$ –11  $\mu$
2. Fam. palmell. long. . . . . ad 2.5 mm.  
 Cell. diam. . . . . 4–10 (–13)  $\mu$   
 Zoospor., v. *supra*.

Found in Pool I only, most abundant in the later stages of each phase, finally forming the bulk of the phytoplankton as the water dried up.

In the early stages of the pool's existence, among masses of *Volvox Rousseletii* colonies, small rounded *Eudorina*-like gelatinous colonies containing usually 32, occasionally 8 or 16, cells are fairly common (fig. 6, A). They are distinguished from the *Eudorina* colonies which are present in the same material by (1) absence of cilia, (2)

\* Wille (1903) and Lemmermann (1915) sink this genus in *Gloeococcus* A. Braun, but Chodat (1904) contested this, and West (1916, p. 186) accepts Chodat's genus as distinct. As it does not appear that any fresh facts have been added to the knowledge of the two species constituting Braun's genus (*cf.* Lemmermann, *loc. cit.*, p. 32) which are still described as "incompletely known," and in which there is apparently nothing whatever to correspond to the very characteristic spherical form described by Chodat, West is followed here, and Chodat's genus accepted (see p. 505). Oltmanns (1923, vol. i, p. 243, etc.) also accepts Chodat's genus.

thicker but less regular outer membrane with numerous attached granules of foreign matter, (3) more closely adpressed cell membrane round the constituent cells, and (4) different behaviour when treated

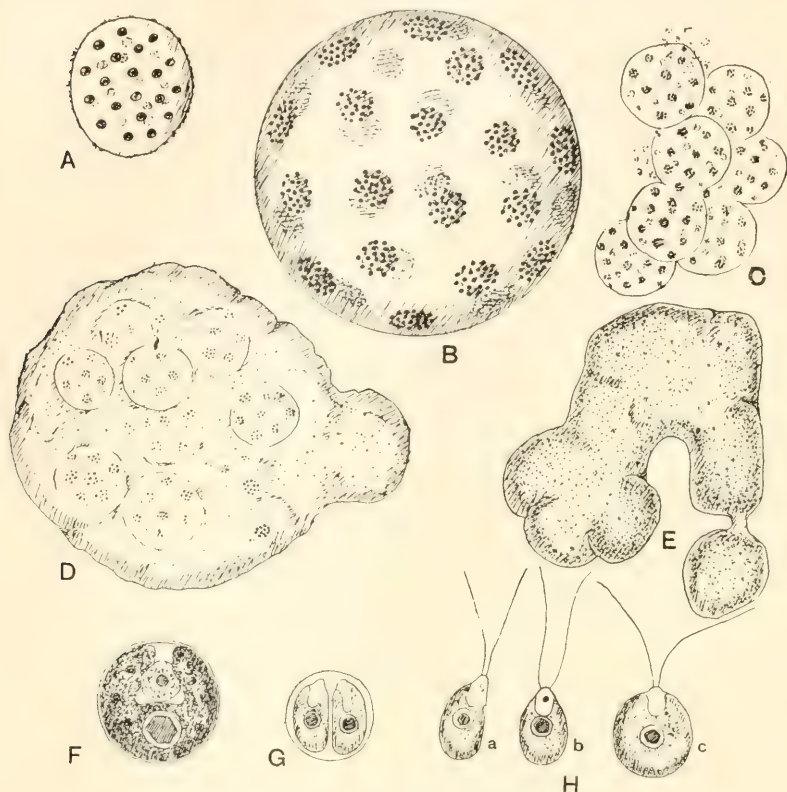


FIG. 6.—*Sphaerocystis Poweri*, sp. nov.

A, Eudorina-form; B, typical spherical colony; C, botryoidal form; D, transition from spherical to Tetrastroma-form; E, Tetrastroma-like colony; F, cell from spherical form; G-H, motile stage of either spherical or palmelloid form; I, division of a cell to form two zoospores; H, mature zoospores—*a*, *b*, smaller type seen from the side and from the back respectively; *c*, larger, more rounded type.

A  $\times 100$ ; B, D  $\times 35$ ; C  $\times 150$ ; E  $\times 30$ ; F-H  $\times 1000$ .

with methylene blue, the mucilaginous envelope and matrix reacting differently to the stain.

The small *Eudorina*-like colonies appear very soon after the pool has formed; for example, in the third phase they occur with the *Volvox* "Juveniles" collected on 2nd March (Plate XXXVI, A), and may be either spherical or slightly elongated. One measured

$141 \times 163 \mu$  and contained 32 cells  $19 \mu$  in diameter, of which one had already divided once. In this material practically all contained 32 cells; the colonies varied from  $49 \times 57 \mu$  to  $215 \times 236 \mu$ . It appears to be a very early developmental stage, and during the later development of the plankton is very rare. The individual cells soon divide up into groups; and the resultant colonies, containing usually 16 or 32 groups of 8, 16, or 32 cells each, are the characteristic spherical colonies which form such a striking constituent of the phytoplankton (*cf.* Plate XXVI, B). The groups are placed at regular intervals within the periphery of the sphere; the cells of each group move apart and are themselves arranged regularly within the much enlarged wall of the parent cell, the resultant group being elliptical in radial section (fig. 6, B, and Plate XXXVI, B). Later, each cell of the group divides similarly, the group becomes spherical, the surrounding membrane more clearly defined, the parent envelope alters, and the daughter colonies escape, with their constituent groups already fully formed (Plate XXXVI, C to E). Throughout this phase there is extraordinary regularity in the numbers of cells and their spacing, division evidently going on more or less simultaneously throughout the colony, both before and after birth. Occasionally spheres in which the full number of groups had not formed were seen, but, as a rule, the number is very regularly 16 or 32, and in the majority of cases, if one group contained 16 cells, all the others had a like number. In colonies where division was going on the constituent groups may not all be exactly at the same stage of development (Plate XXXVI, C, D), but, as a rule, all divide very nearly simultaneously (Plate XXXVII, A).

The cells (fig. 6, F) are spherical or very nearly so; each is surrounded by a delicate wall, usually only apparent on staining, has a massive bowl-shaped chloroplast, a single very large basal pyrenoid, and a central nucleus with a large nucleolus (or "inner body"). Much starch is formed, the whole chloroplast becoming packed with it. The vesicle surrounding each group, *i.e.* the enlarged wall of the parent cell, is hardly visible without staining in young colonies, but in older colonies it may show fairly clearly (Plate XXXVII, A).

Apparently reproduction by the formation of daughter colonies, as described above, may continue for some time, each daughter colony escaping and developing separately. Or the gelatinous envelopes may soften, and the daughter colonies, instead of escaping separately, each enclosed in a firm membrane, remain in contact with one another, forming an irregular botryoidal mass (fig. 6, C,

and Plate XXXVII, B), in which no limiting membranes can be seen. Even the gelatinous matrix is invisible until stained. With methylene blue it turns purple, and it is clear that there is no differentiation of a surface membrane. Apparently this botryoidal form only arises from very young colonies, since the spheres and their constituent cells are always very small and delicate. This form was the rarest, and occurred most abundantly in material which contained fairly advanced stages of *Volvox gigas*.

Finally, yet a third form, the *Tetraspora*-like form (fig. 6, E), occurs at first in small quantities (Plate XXV, D, top left-hand corner), but rapidly increases until it forms nearly the whole of the phytoplankton (Plate XXXVI, E, and Plate XXXVII, E). Apparently it may arise either from the botryoidal form or from the spherical. In the former case the constituent cells divide repeatedly, the gelatinous matrix extends and its composition alters slightly, the outer layers becoming denser. Transition stages from one form to the other are occasionally seen, though they are not common. When a colony of the spherical type is passing over into the *Tetraspora*-type (fig. 6, D, and Plate XXXVII, D, E), the cells of the groups divide as if to form daughter colonies, but the resultant cells continue to divide more or less irregularly (Plate XXXVII, D), some at any rate forming biciliate zoospores which move through the gelatinous matrix; this has meanwhile been losing its firm outline, often becoming irregularly lobed (fig. 6, D). Eventually all trace of grouping of the cells is lost, and an irregular gelatinous mass, packed with small rounded cells (Plate XXXVII, C) similar in structure to, but smaller than, those of the spherical form of the alga, is formed.

There is no trace of pseudocilia, and here, as in the spherical form, zoospores of two sizes are often seen, some ranging from  $4 \times 7 \mu$  to  $5 \times 9 \mu$ , others from  $8 \times 10 \mu$  to  $9$  or  $10 \times 11 \mu$ ; the cilia are equal in length to, or slightly longer than, the protoplast, the chloroplast cup-shaped with nearly central pyrenoid. The zoospore is elongated, slightly oblique, with a very small apical protuberance and central pyrenoid (fig. 6, H).

Thus the characteristic *Tetraspora*-like palmelloid stage consists of irregularly shaped gelatinous masses containing very large numbers of rounded cells without ciliary appendages of any form, except where the round cells have divided to form small elongated bi-ciliate zoospores. The colonies may be more or less rounded, but are more often elongated, irregularly lobed or branched, often 2 mm. or more in length. The cells, similar in form and structure to those of the



spherical phase, but smaller, usually show no grouping, but sometimes grouping in fours or even eights is very marked. This probably depends on the rate at which division is proceeding—unless the rate is high the daughter cells separate before the next division takes place, and all trace of grouping is lost. In some colonies the number of zoospores among the round cells is very great.

The four stages are so very distinctive that were it not for the intermediate stages which occur they might easily be taken as belonging to different genera.

The entire absence from all stages except that of the motile zoospores of any trace of cilia or pseudocilia distinguishes this genus not only from the *Tetrasporaceae*, but also from *Gloeococcus*, as defined by Braun. It is difficult to understand the view taken by Wille (1903) and Lemmermann (1915, p. 31) in regarding *Sphaerocystis* Chodat as identical with Braun's genus, since Braun in his definition of the genus (as quoted by Rabenhorst, 1868, iii, p. 36) explicitly describes the presence of cilia: "*Cellulae ovaes, virides, in parte antica ciliis vibratoris binis . . . instructae*" (cf. also Chodat, 1904, p. 233), and in the following description amplifies this, stating that: "The cells in all the succeeding generations which take place during the formation of these families except the transitory generations (in the case of repeated division) are provided with two very long persistent moving cilia which only disappear at the beginning of division" (Braun, 1851, quoted by Chodat), whereas in *Sphaerocystis* cilia are present only in the zoospores.

In the Kimberley material the palmelloid colonies may reach a fair size, up to 3 or 4 mm. in length, but this is a very different matter from families the size of an apple or a hazel-nut which characterise the two species of *Gloeococcus* on which Braun founded his genus.

W. and G. S. West (1912, p. 413) found that *Sphaerocystis Schroeteri* formed a large part of the phytoplankton of Loch Lomond during the warmer months only (July to October), and was not seen during the colder periods of the year. Although even then the temperature of the water (59° F. or 15° C.) was very much lower than that of the Kimberley pool (25° to 30° C.), yet the observation is suggestive. No doubt, at least, a part of the associated palmelloid material which these workers diagnosed as *Tetraspora lacustris* was actually the corresponding form of *Sphaerocystis*, since it is evident that pseudocilia were not seen in this material (West, 1916, p. 186).

The spherical form of *Sphaerocystis Poweri* differs from *Sphaerocystis Schroeteri* Chod. (1897a, p. 119, and 1897b, p. 292), in the very great



regularity of development and arrangement of the constituent groups of cells; the almost perfect spheres with their symmetrically placed groups of equal numbers of equally spaced similar cells are very beautiful objects, and very different from the spheres containing groups at all stages of development characteristic of Chodat's species; this irregularity of development is well shown in the figures accompanying his description (1897*b*, pl. ix, particularly figs. 1, 5, and 7), and was so striking that Chodat made special mention of it as a characteristic feature of the species.

The following examples are chosen from the many examined to give an idea of the spherical colonies:—

Colony.	No. of cells or groups.	Constitution of groups.
49 × 57 $\mu$	32 cells (very young)	Cells rather close together.
160 × 170 $\mu$	16 cells (20 $\mu$ )	Cells arranged peripherally.
215 × 236 $\mu$	32 cells	1 cell dividing.
500 × 500 $\mu$	8 groups	Each containing 16 cells.
990 × 990 $\mu$	16 "	" " 16 "
990 × 990 $\mu$	16 "	Each containing 16 cells, each already divided into 8.
1012 × 1012 $\mu$	32 "	Each containing 8 cells (13 $\mu$ ).
1012 × 1012 $\mu$	32 "	" " 16 " (10 $\mu$ ).
1500 × 1500 $\mu$	32 "	" " 32 " (15–18 $\mu$ ).
1615 × 1615 $\mu$	32 "	" " 32 " (20–26 $\mu$ ).
1000 × 1000 $\mu$	16 "	Each containing 16 cells, some already divided.

### C. PROTOCOCCALES, SCENEDESMACEAE.

Genus KIRCHNERIELLA Schmidle.

*Kirchneriella africana* sp. nov.

(Fig. 7, and Plate XXXV, G, H.)

Familiae magnae, usque ad 2–4 mm. longis, juvenae fere rotundae, maturae plerumque fere teretes saepe lobatae vel ramosae; cellulis permultis, in tegumento gelatinoso hyalino sine regula dispositis, magnitudine variis; cellula trilobata, basi rotunda, apice profunde emarginato, lobis lateralibus divergentibus, interdum sub-recurvis;

chromatophora late patenti, parietali, lobata, pyrenoide singulo in parte basali.

Fam.,  $322 \times 430 \mu$ ,  $1290 \times 2350 \mu$ ,  $1400 \times 2910 \mu$ ,  $862 \times 4000 \mu$ , etc.

Cell.,  $4 \times 5 \mu$ – $16 \times 13 \mu$ .

Cell., e.g.  $9 \times 9 \mu$ ,  $12 \times 11 \mu$ ,  $16 \times 13 \mu$ ,  $13 \times 14 \mu$ .

Found in Pool I associated with *Sphaerocystis Poweri*, *Volvox Rousseletii* forma *griquaensis* and *Volvox gigas*.

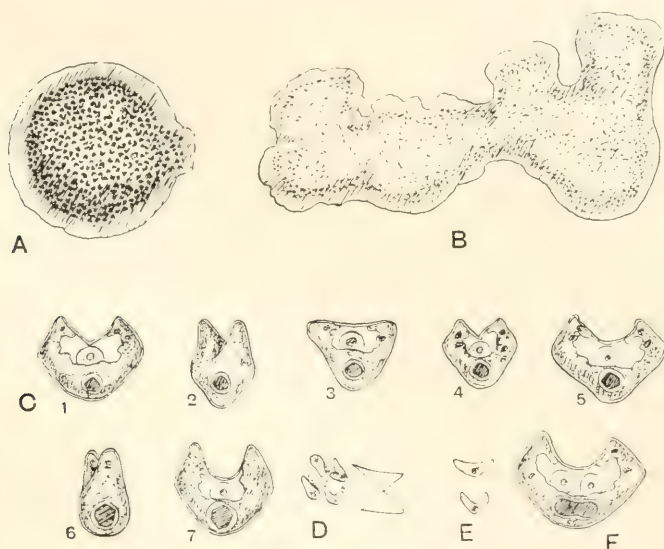


FIG. 7.—*Kirchneriella africana*, sp. nov.

A, B, Typical colonies. A, young, rounded colony; B, older, much lobed, elongated colony of large size; C, 1–7 cells of various shapes and sizes from a single colony; D, group of four cells formed by division of a single large cell, the empty wall of which lies adjacent to the group; cells show the characteristic shape even at this stage; E, two very young cells, one nearly straight, the other three-lobed; F, large cell with nucleus already divided and pyrenoid dividing.

A  $\times 70$ ; B  $\times 30$ ; C–F  $\times 1500$ .

A very large form; the gelatinous colonies are more or less rounded when young (fig. 7, A), later becoming elongated and irregularly lobed or branched (fig. 7, B), often 1 to 2 mm. in length, while the largest colony as yet observed measured 4 mm. in length by nearly 1 mm. in the widest part.

The cells are very numerous, embedded without definite orientation within the colourless gelatinous matrix, very variable in size and form in one and the same colony (fig. 7, C; Plate XXXV, H), usually tending

to be three-lobed; basal lobe massive, rounded, apical lobes usually widely divergent, separated by a wide and deep cleft somewhat V-shaped, but with rounded base. Typically this cleft is about one-third the total length of the cell in depth, more rarely it may be quite shallow (fig. 7, C 3). The apices of the lobes are more or less narrowly rounded, sometimes slightly recurved. The parietal chloroplast is extensive, slightly lobed, lining most of the cell except a small part beneath the cleft; in this the nucleus lies (*i.e.* approximately in the centre of the cell). The single large pyrenoid lies in the massive basal part of the chloroplast. The cells are rich in starch, and contain, in addition, refrangent globules, probably volutin, generally most conspicuous in the apical lobes. The wall is delicate, closely adpressed to the protoplast, only becoming apparent on staining, *e.g.*, with iodine or methylene blue. With the latter the gelatinous matrix stains faintly bluish purple, the protoplast deep blue.

The cells divide to form 4- or 8-celled groups (fig. 7, D); the empty wall of the parent cell is often visible near such groups of young cells. The three-lobed structure is apparent at a very early stage (fig. 7, D), but sometimes the young cells appear almost straight (fig. 7, E). As the cells thus formed grow they diverge from one another, and all trace of grouping is soon lost.

This species appears to be nearest *K. Malmeana* (Bohlin) Wille, (*cf.* Brunnthaler, 1915, p. 181, fig. 266), but the cells are typically much more deeply incised and more distinctly three-lobed, with rounded apices, than in that species, although some cells occur in which the anterior end is only slightly concave (fig. 7, C, 3). The mature cells here are larger than in most species and the colonies very much larger than anything as yet recorded for the genus; the number of component cells, too, is exceptionally great.

Large cells in which the nucleus or pyrenoid had already divided, presumably preparatory to cell division, were occasionally seen (fig. 7, F).

On and inside many of the colonies biciliate motile cells were often found, but, as these are identical with the zoospores of *Sphaerocystis Poweri*, it is almost certain that they belong to that species, and have penetrated the matrix of the *Kirchneriella* colonies. In the same way they may enter older *Volvox* colonies of either of the associated species (*cf.* Plate XXX, B).

PART III.—FIELD OBSERVATIONS AND RECORDS.

*Pool I.*—The pool where *Volvox* was first found lies in an excavation roughly 40 yards in diameter and about  $3\frac{1}{2}$  feet deep in the deepest part. It was made some eight years ago by the removal of red clay for building purposes, and the bottom and sides are composed of this red earth. Any water which lodges in it is very muddy and of a reddish colour. It lies about a mile to the S.E. of Kimberley, just off the Samaria Road and close to the Bultfontein Floors.

*Volvox* was first collected here in November and again early in December 1931. The pool dried up about the middle of December, but was filled again by a thunderstorm during the afternoon of Saturday, 23rd January, and remained in existence for about four weeks, the last collection being made on 18th February. By 24th February it was completely dry.

The third phase was started by a thunderstorm during the night of Saturday, 27th February, and this time the pool had a rather longer existence, another storm on 19th March partially refilling it before it had quite dried, so that it continued some days longer; but it was dry again by 2nd April, and with that date the observations on this pool finish. *Volvox* disappeared from it about the 19th of March, and did not reappear.

*Pool II.*—No other *Volvox* pools were found until after the last rains, when *Volvox* was collected in two more quarry pools. The second one lies about 4 miles S.W. of the town. The sides and bottom are of broken stone and the water clear.

The phytoplankton consisted entirely of asexual material of *Volvox Rousseletii*, with a very small proportion of *Volvox africanus* mixed with it. Streptocephalids, abundant in all the pools, were particularly so here.

*Pool III.*—The third pool is of yet a third type, though it also is in a quarry. This quarry, however, is in limestone tufa which forms the sides and bottom of the excavation; the latter is covered with mud and the water is very muddy.

The pool lies about  $1\frac{1}{2}$  miles N.E. of Kimberley; it was fast drying up when *Volvox* was first found in it and was only visited twice. The *Volvox* was very scarce, and consisted entirely of asexual colonies, mostly immature but large, markedly egg-shaped, and containing numerous embryo colonies.

On analysis, the water was found to contain .92 per cent. lime and

Date.	Rainfall.	State of pool.	<i>Volvox Rousssetii</i> f. <i>grignaniensis</i> .	<i>Volvox gigas</i> .	<i>Sphaerocystis Poveri</i> . (a) = <i>Eudorina</i> form. (b) = Spherical. (c) = Botryoidal. (d) = Tetraspora form.	<i>Kirchneriella africana</i> .	<i>Eudorina elegans</i> .
<i>Phase I.</i> : Nov. 1931	..	(Temperature of water varied from 25-30° C. throughout observations.) Pool about 150 sq. yards in extent and 2½ feet deep in deepest part.	Asexual colonies only.	..	..	..	..
10th Dec. "	..	..	Asexual and sexual; many young. Asexual → 1507 × 1571 μ, embryos → 409 × 431 μ, ♂ → 1271 × 1615 μ, ♀ → 1292 × 1443 μ.	Occasional, very young, → 423 × 478 μ with over 30 undivided gonidia.	(b) Occasional, large; a few transitional; (d) rare.	Fairly common, large, → 3.6 mm. × 5 mm.	Occasional.
20th " "	..	Completely dry.	..	..	..	..	..
<i>Phase II.</i> : 23rd Jan. 1932	Heavy rain during night.	Pool re-formed.	..	..	..	..	..
31st " "	..	Water 6 inches to 1 foot deep.	Sexual much more abundant than asexual, very large number of eggs and Androgonidia per colony. Embryos mostly < 8, but → 10. Asexual → 1507 × 1679 μ, embryos → 366 × 430 μ, ♂ → 1656 × 1271 μ, ♀ → 1012 × 1163 μ.	..	(a) Occasional.	..	..
8th Feb. "	..	..	Sexual still predominant, but asexual more numerous. Some infested with <i>Proales</i> .	Occasional, young, → 1142 × 1250 μ, gonidia 32 μ.	(a) Very occasional, 23-celled; (b) occasional; (c) fairly common; (d) rare, cells small, zoospores swarming inside old <i>Volvox colonies</i> .	Fairly abundant, large, cells dividing actively.	Occasional, large, some with daughter colonies.
12th " "	..	..	Asexual predominant, young very egg-shaped, embryos → 12, more numerous in young than in older colonies. ♂'s abundant, small; many ripe oospores.	Fairly abundant, mostly young, a few mature.	(a) —; (b) fairly abundant; (c) —; (d) occasional cells comparatively few.	Rare.	Occasional, some small, 53 × 62 μ.
18th " "	..	4 inches deep, about 60 yards in area.	Rare, mixed with very abundant crustaceans.	..	..	..	..



24th Feb. 1932	..	Completely dry.	..	..	..	..	..
"Phase III." 27th Feb. 1932	Heavy rain during night.	Pool refilled.	..	..	..	..	..
29th " "	..	Pool about 1½ foot in deepest part.	..	..	..	..	..
2nd Mar. " " 9.30 a.m.	..	"Juveniles" and colonies of 2nd generation. Juveniles → 473 × 517 μ, embryos 1-5.	..	(a) Fairly common, all 32- celled; (b) very rare. 49 × 57 μ → 245 × 256 μ.	..	Very rare, small, 66 × 88 μ.	..
4th Mar. 1932 9.30 a.m.	..	Abundant asexual, with large embryos, mostly over 8 → 17 per colony. ♂ abundant, many mature. ♀ very rare. Juveniles very occasional.	..	(a) Occasional; (b) —; (c) very rare; (d) —.	..	Occasional, large c, → 155 × 139 μ, cells 18 μ.	..
7th Mar. 1932 10.30 a.m.	..	<i>Dominant species.</i> Sexual predominant. Asexual with few embryos, 2-9, usually < 8 per colony. ♂ very abundant, 473 × 517 μ → 1031 × 1186 μ. ♀ mostly young, 774 × 862 μ → 1250 × 1356 μ. Eggs over 300 per colony.	Occasional, mostly young, a few with dividing gonidia or embryo colonies.	(a) 0; (b) occasional; (c) very rare; (d) rare.	Rare.	Occasional, large c, → 194 × 215 μ, cells 18 μ.	..
11th " "	..	Still dominant; asexual slightly more numerous than sexual. Embryos → 12. Asexual → 1636 × 1680 μ.	Fairly abundant, mostly young, asexual, some mature. Sexual rare.	(a) Very rare; (b) fairly common, mostly small; (c) fairly common; (d) fairly common, dividing actively.	Fairly abundant, large masses.	Occasional, large c, → 215 × 258 μ.	..
14th " "	..	Much less abundant, asexual predominant.	<i>Dominant species.</i> All stages, asexual and sexual.	(a) Very occasional, some 16-celled; (b) abundant; (c) occasional; (d) very abundant.	Large, numerous, but less so than <i>Sphaerocystis</i> (d).	..	..
18th " "	Some rain during night.	Pool nearly dry, refilled partially.	..	(a) —; (b) large, abun- dant; (c) —; (d) <i>Domi-</i> <i>nant</i> , very abundant in- deed.	Occasional, large.	..	..
21st " "	..	Pool 2 inches deep in isolated spots near centre.	Very occasional, mostly asexual.	(a) —; (b) rare; (c) —; (d) constitutes almost the whole phytoplankton.	Very occasional.	..	..
30th " "	..	..	..	..	..	..	..
2nd Apr. "	Some rain during night.	Pool dry.	..	..	..	..	..

·004 per cent. sodium chloride, *i.e.* about twice and three times respectively the normal amount in Kimberley tap-water.

Most of the collecting was done from Pool I—when the pool filled and the water was comparatively deep it was from the surface layers only; for instance, on 31st January: “The water was about 6 inches to 1 foot deep where the collecting was done, and the net was never immersed more than 3 inches. The *Volvox* [*i.e.* *V. Rousseletii*] was very plentiful, one sweep of the net being sufficient to collect quite a quantity.” It is possible that the non-motile algae are as a rule not actually at the surface but floating in a somewhat lower stratum, and that therefore the collecting at the beginning of each phase does not present the phytoplankton in its entirety; at the same time it seems improbable that this is the whole explanation of the increasing proportion of these algae as the water grows lower. There is certainly a continual increase in their number and bulk as the pool ages; but possibly, if deeper collectings were made in the early stages of the pool’s existence, the number of individuals of these species would be found to be more numerous, and a more complete picture of their development could be given. As it is they are a sufficiently striking constituent of the vegetation of the pool. On the last occasion that a collection was made from this pool (2nd April) the gelatinous algae are described as forming “a solid mass at the N.W. side of the pool, making the water there a vivid green. Eventually, when the pool dried up, they formed a thick green layer in several small depressions in the mud. The temperature of the water varied from 25° to 30° C. during the whole period of collecting. The collecting was usually done between the hours of 9.30 a.m. and 12 noon.”

The amount of *Volvox* often varied in different parts of the pool according to the prevailing wind; when a strong wind was blowing the *Volvox* tended to collect at the leeward end of the pool.

The table on pp. 510, 511 shows the succeeding changes in the pool and its vegetation during the time it was under observation, the latter as shown by the material collected and preserved at each visit to the pool. It must be emphasised that this does not pretend to be the full history of the phytoplankton, since, as the collecting was done entirely with a view to the study of *Volvox*, no attempt was made to obtain its finer constituents apart from those incidentally collected with *Volvox*.

# SUMMARY.

1. *Volvox* has been found in three temporary rain-water pools in quarries near Kimberley; these pools may fill and dry up several times during a single season, *Volvox* disappearing before the pool is dry and reappearing soon after it refills.

2. Of these three pools the first one found—Pool I—was visited repeatedly from November 1931 to the beginning of April 1932, during which time it came into existence on three separate occasions, the duration of the pool varying from three to five weeks, alternating with periods of dryness varying from a few days to several weeks. On each visit collections were made and preserved in formalin or iodine. The other two pools were not discovered until late in the season, after the last heavy rain, and the collections from these are consequently few and scanty.

3. Three species of *Volvox* were found: one, a local variant of the widespread *V. Rousseletii*, was common to all three pools; the second, a startlingly large one, sometimes as much as 3 mm. in diameter, is diagnosed as a new species to which the name *Volvox gigas* is given. It was found in Pool I only. The third is a very large form of *Volvox africanus* G. S. West, usually containing four pairs of embryos; it occurred in small quantities, entirely asexual, in Pool II only.

4. In Pool I three other algae are associated with the two species of *Volvox*, namely:—

- (a) *Eudorina elegans*, mainly large colonies, occurring in small quantities in the tubes, probably very much more numerous in reality;
- (b) An interesting, very polymorphic gelatinous non-motile alga, described as a new species, *Sphaerocystis Poweri*, one form of which eventually becomes the dominant alga in the pool; and
- (c) A large, very many celled species of *Kirchneriella*, described as *K. africana* sp. nov.

5. The phytoplankton of Pool I shows an interesting succession, of which the following are the main phases:—

- (a) *Volvox Rousseletii* dominant, *Sphaerocystis* present in small quantities, and, towards the end, young colonies of *V. gigas*.
- (b) *Volvox Rousseletii* becoming less numerous, *V. gigas* increasing, sometimes becoming dominant, *Sphaerocystis* and *Kirchneriella* increasing;

(c) *Volvox* scarce or absent, *Sphaerocystis* dominant, *Kirchneriella* fairly numerous;

(d) Vegetation consisting almost entirely of the palmelloid form of *Sphaerocystis Poweri*; pool almost dry.

6. A summary of the seasonal history from November 1931 to April 1932 of Pool I and its vegetation is given in tabular form.

#### DISCUSSION AND CONCLUSION.

Occurrence in a region of summer rainfall appears to be peculiarly favourable to the development of *Volvox*—all the three species found in the Kimberley district are outstanding either for their size, *e.g.* *V. gigas* and *V. africanus*, or for the extreme richness of development, *e.g.* the reproductive cells of *V. Rousseletii*, particularly the sexual cells. With this may be compared *V. amboensis*, Rich and Pocock (*loc. cit.*, p. 462), from a region which has very similar climatic conditions to Kimberley. That a comparatively high temperature is favourable for development in *Volvox* was also suggested by observations in 1931 of *V. capensis* on the Cape Flats.

The same is true of the associated algae, all of which are large of their kind—even the *Eudorina* colonies are unusually large, the *Kirchneriella* is larger than anything previously recorded for the genus, while *Sphaerocystis Poweri* shows great luxuriance of growth.

Of recent years much work has been done on the algae of South Africa, but mainly from the systematic standpoint, consisting in the identification and description of species and records of occurrence as shown by more or less isolated collections. As yet the ecological aspect has hardly been touched; quite recently an ecological study of the plankton of various pans and other inland waters has been published (Hutchinson, Pickford, and Schuurman, 1932), but even this very interesting piece of work deals with *seasonal* observations in two only of the localities under review. A more detailed study of the seasonal changes in planktonic life, extending over a period of two years, was made in the case of Florida Lake, Johannesburg, by Miss Schuurman (1932). Both these papers deal only with the plankton. As yet no study of the seasonal succession of the algal vegetation as a whole has been published for any piece of water in South Africa. Further, in most cases the pans or vleis concerned in these two papers are either permanent (*e.g.* Florida Lake), semi-permanent, or extensive artificial bodies of water very different from the small temporary pools near Kimberley. Such rain-water pools, either as in this case in artificially made hollows in the surface of the

ground or in natural depressions, are very characteristic of large areas in Africa. If the rains are good they may fill up yearly or several times each year; on the other hand they may remain dry for several years in succession. When they do fill, their duration is often very brief, often only a week or two, yet in that time an extraordinarily rich algal flora often develops. Obviously such pools would often form most favourable subjects for intensive observation. The Kimberley pool is apparently of comparatively recent origin, and it seems probable that far richer results could be obtained by a systematic study of some of the many small temporary pools which form in natural hollows in high veld regions one wet season after another, and have probably done so from time immemorial.

The present account is as far as is known the first attempt as yet made to describe the seasonal changes in a part at least of the flora of such a transitory pool, and since it is compiled from a series of observations and collections made with one object only, namely the study of the behaviour of the single genus *Volvox*, it will be obvious that its value as a general seasonal history of the pool is small. It may, however, serve to illustrate the interest and value of a detailed study of the algal vegetation of individual pools of this kind, and it seems time that such seasonal studies should be initiated to supplement our growing knowledge of the systematic side of freshwater algology in South Africa, and to correlate it with the occurrence of the various constituents of the rich and varied algal flora of this country under varying local and seasonal conditions.

RONDEBOSCH, CAPE PROVINCE,

July 1932.

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DESCRIPTION OF PLATES.

The number in brackets at the end of each description denotes the reference number of the original negative.

PLATE XXV.

*Volvox gigas* sp. nov.

FIG.

- A. Group, four large asexual colonies with young embryos and gonidia, and a very young colony; in the centre an asexual and a mature male colony of *V. Rousseletii* forma *griquaensis* (602).

Dimensions: *V. gigas* (1) 2000  $\mu$ , (2)  $2148 \times 2590 \mu$ , (3)  $2222 \times 2660 \mu$ , (4)  $2814 \times 3111 \mu$ . *V. Rousseletii*: asexual 1111  $\mu$ , male  $740 \times 880 \mu$ .

- B. Male and female colonies, the latter with large scattered oospheres; the male colony in B2 typically egg-shaped. In both males all the cells in the posterior part of the colony are developing into sperm bundles; spaces among the cells show where sperm bundles have already escaped (627).
- C. Small mature colony with few-celled embryos, probably males (compare with Plate XXVI, E), and a few oospores (694).
- D. Group, showing very young and nearly mature asexual colonies (one with between 50 and 60 embryos), mixed colonies with eggs and embryos, and pure male and female colonies; at the top left-hand corner are two spherical and three or four palmelloid colonies of *Sphaerocystis Poweri*, while near the bottom right-hand corner is a small spherical colony beginning to show transition to the palmelloid state (639).

A  $\times 13.5$ . B  $\times 25$ . C  $\times 38$ . D  $\times 16$ .

PLATE XXVI.

*Volvox gigas*. Stages in development of asexual colonies.

- A. Young colony with undivided gonidia, many still enlarging (634).
- B. Older colony with several embryos inverting (631).
- C. Daughter colonies fully formed but still very small. Colony  $2283 \times 2498 \mu$ , with 64 daughters (629).
- D. Colony with 42 daughters in various stages of enlargement, gonidia distinguishable in the larger (618).
- E. Daughter colonies 28, mature and ready for escape; gonidia distinct. On the right, part of a colony with recently inverted daughters (617).
- F. Inverting embryo in "Hat" stage; side view showing wall of parent colony, adjacent somatic cells and older embryo slightly out of focus (685).

A  $\times 70$ . B  $\times 45$ . C to E  $\times 25$ . F  $\times 390$ .

PLATE XXVII.

*Volvox gigas*. Inversion of embryo.

- A. Phialopore wide open, lips nearly straight; protoplasmic connections between the cells at the edge of the lip were clearly visible (689).

FIG.

- B, C. Lobes of the phialopore folding back. In B the connections between the cells can just be seen in the central lobe. C shows the same colony further enlarged, focussed to show the four-sided opening (684, 688).  
 D. "Hat" stage (cf. Plate XXVI, F), wall of vesicle and parent showing clearly (687).  
 E. Inversion just completed, phialopore (in centre of flattened side) nearly closed (686).  
 F. Cilia beginning to elongate (690).  
 G. Cilia fully developed, common envelope forming (691).

A, C, D, and F  $\times 680$ . B, E  $\times 390$ . G  $\times 900$ .

## PLATE XXVIII.

*Volvox gigas*. Male colonies.

- A, B, D with large and small sperm bundles, C with small bundles only. In A, C, and D are numerous gaps left by sperm bundles which have already escaped. B was focussed down through the colony on to the under side, hence the sperm bundles, etc. are seen from the back (633, 640, 641, 610).

A to C  $\times 70$ . D  $\times 63$ .

## PLATE XXIX.

*Volvox gigas*. Development of the Antheridium.

- A. Portion of male colony showing antheridia in various stages of division and inversion, and sperm bundles of three sizes. Note absence of somatic cells (624).  
 B. Largest sized antheridium before second division has been quite completed; the dividing line is clearly defined in the centre but has not yet extended to the edges, whereas the line of the first division is well defined right across. The commencement of the hollowing to form the bowl-shaped sperm bundle is already distinct (605).  
 C to E. Mature sperm bundles of three sizes *in situ* (607, 608, 606).

A  $\times 330$ . B  $\times 1000$ . C to E  $\times 750$ .

## PLATE XXX.

A to D. *Volvox gigas*. E. *Volvox africanus*.

- A. Portion of male colony showing antheridium mother-cells undivided and in various stages of division and two mature sperm bundles of different sizes (636).  
 B. Mixed colony with daughter colonies and developing oospheres; to the left of the centre the colony has been invaded by *Sphaerocystis* zoospores, which have settled down and rounded off in the gelatinous envelope of the coenobium (612).  
 C. Two oospores, one nearly ripe, and two oospheres or very young oospores with several long drawn-out spermatozooids (probably already dead when the material was fixed) (635).

FIG.

D. Portion of mixed colony with young daughter colony in which the difference between gonidia and somatic cells is already well defined, a young oospore, two somatic cells, and several scattered spermatozooids (623).

E. *Volvox africanus*, recently inverted daughter colony showing the four equatorial gonidia projecting from the periphery (657).

A, C  $\times 545$ . B  $\times 45$ . D, E  $\times 330$ .

PLATE XXXI.

*Volvox africanus* G. S. West.

A. Group of colonies showing general appearance; embryos in all stages of development from undivided gonidia to mature daughter colonies ready to escape and containing embryos already in advanced stages of division (649).

B, C. Colonies with maturing embryos, C stained with methylene blue to show the membranes. The gap left by the escape of an equatorial embryo shows at each side; the three remaining daughters have developed from the more posterior gonidia, pushing up the inner membrane of the parent colony as they increased in size. This colony, unstained, is on the right in the group above (650, 652).

D. Younger colony with four large equatorial and a very much younger pair of posterior embryos (651).

A  $\times 25$ . B to D  $\times 70$ .

PLATE XXXII.

*Volvox africanus*. Inversion of embryo.

A, B. Large colony with two pairs of maturing embryos (equatorial), one pair recently inverted, in one of which the gonidia have sunk into position, while in the other they are still projecting (see Plate XXX, E), and one pair in the process of inversion. A, top, and B, median focus (654, 653).

C, D. Inverting daughters from the above, side view. In D the folded-back lip is straightening out, forming a wide fringe round the embryo (656, 655).

E. Phialoporic view of D; four large gonidia lie in the depression just outside the four sides of the pore (659).

A, B  $\times 70$ . C, D  $\times 330$ . E  $\times 520$ .

PLATE XXXIII.

*Volvox africanus*. Inversion of the embryo, continued.

A, B. Early "hat" stage of inversion, edge of phialopore folding back doubled up; in A a gonidium shows at the bend on the right. B, the same colony with slightly different focus, showing the pointing of the outer ends of the cells in the posterior region (666, 670).

C. Phialoporic view of the same colony (668).

FIG.

D to F. Inversion nearly complete. D, median focus showing the two pairs of equatorial gonidia projecting; cilia just beginning to appear. E, same colony, top focus showing the edges of the closing phialopore. The cells round the edge show connecting protoplasmic strands; in the background, out of focus, the four equatorial gonidia, and on the left one of the posterior gonidia, are just discernible. F, recently inverted colony at a slightly later stage, the phialopore nearly closed and the gonidia sinking inwards to their final position (669, 671, 660).

A  $\times 340$ . B, D to E  $\times 520$ . C  $\times 680$ .

## PLATE XXXIV.

*Volvox Rousseletii* G. S. West, forma *griquaensis*, f. nov.

- A. Group of asexual, male and female colonies fairly early in the sexual phase; some males very large, larger than any females present. One asexual colony with 11 embryos (575).  
 B. Four colonies, one asexual, one very young female with developing oospheres, and two males, one young with numerous developing antheridia and a few mature sperm globoids, the other mature (*cf.* Plate XXV, D, A, and B) (577).  
 C. Group of "Juveniles," with one, two, or three daughter colonies and three free second-generation colonies; below on the left a young *Sphaerocystis* colony in the *Eudorina* stage (700).  
 D, E. "Juveniles" produced by germination of oospores. D, a young Juvenile with gonidia just beginning to divide and a young colony of the second generation recently escaped from its Juvenile parent. E, an older Juvenile with three developing embryos and an undivided gonidium. The large size of the cells and the protoplasmic connections are distinctive (700, 703).

A  $\times 12$ . B, C  $\times 38$ . D  $\times 78$ . E  $\times 100$ .

## PLATE XXXV.

A to F, *Volvox Rousseletii* f. *griquaensis*.

- A, B. Male colonies: A, young; B, mature (578, 579).  
 C. Two mature sperm globoids *in situ*, seen in side and surface view respectively (574).  
 D, E. Female colonies; A, very young, oospheres still enlarging; E, mature, oospores orange in colour (580, 581).  
 F. Group of nearly ripe oospores *in situ* (582).

G, H, *Kirchneriella africana* sp. nov.

Portions of two colonies showing cells of various shapes and sizes facing in all directions, and some groups of young cells formed by division of a single parent cell; empty cell walls appear like two triangles standing on a common base (680, 695).

A, B, D, E  $\times 60$ . C, F  $\times 426$ . G  $\times 383$ . H  $\times 340$ .



## PLATE XXXVI.

*Sphaerocystis Poweri* sp. nov.

FIG.

- A. Early stage, "Eudorina Form," with a Juvenile colony of *V. Rousseletii* f. *griquaensis* containing a nearly mature embryo (702).  
 B. Large colony of the typical spherical form containing 32 groups of 32 cells each (611).  
 C, D. 16-celled groups from a mature spherical colony in which some of the cells are dividing to form sub-groups, also 16-celled, preparatory to the formation of daughter spheres. Stained with methylene blue to show the enveloping membranes. The large pyrenoid shows clearly (663, 661).  
 E. Group showing various forms and stages. On the left a young typical sphere; in the centre a large sphere in which the cells of the groups have divided and the daughter colonies rounded off, the outer membrane of the parent is firm, the inner gelatinous matrix partially collapsed, membranes of the daughters thin but firm. Some of the daughters have already escaped, two of these appearing on the right. Round the edge are portions of rounded and lobed masses of the palmelloid stage or "Tetraspora Form" (681).

A  $\times 100$ . B  $\times 54$ . C, D  $\times 325$ . E  $\times 45$ .

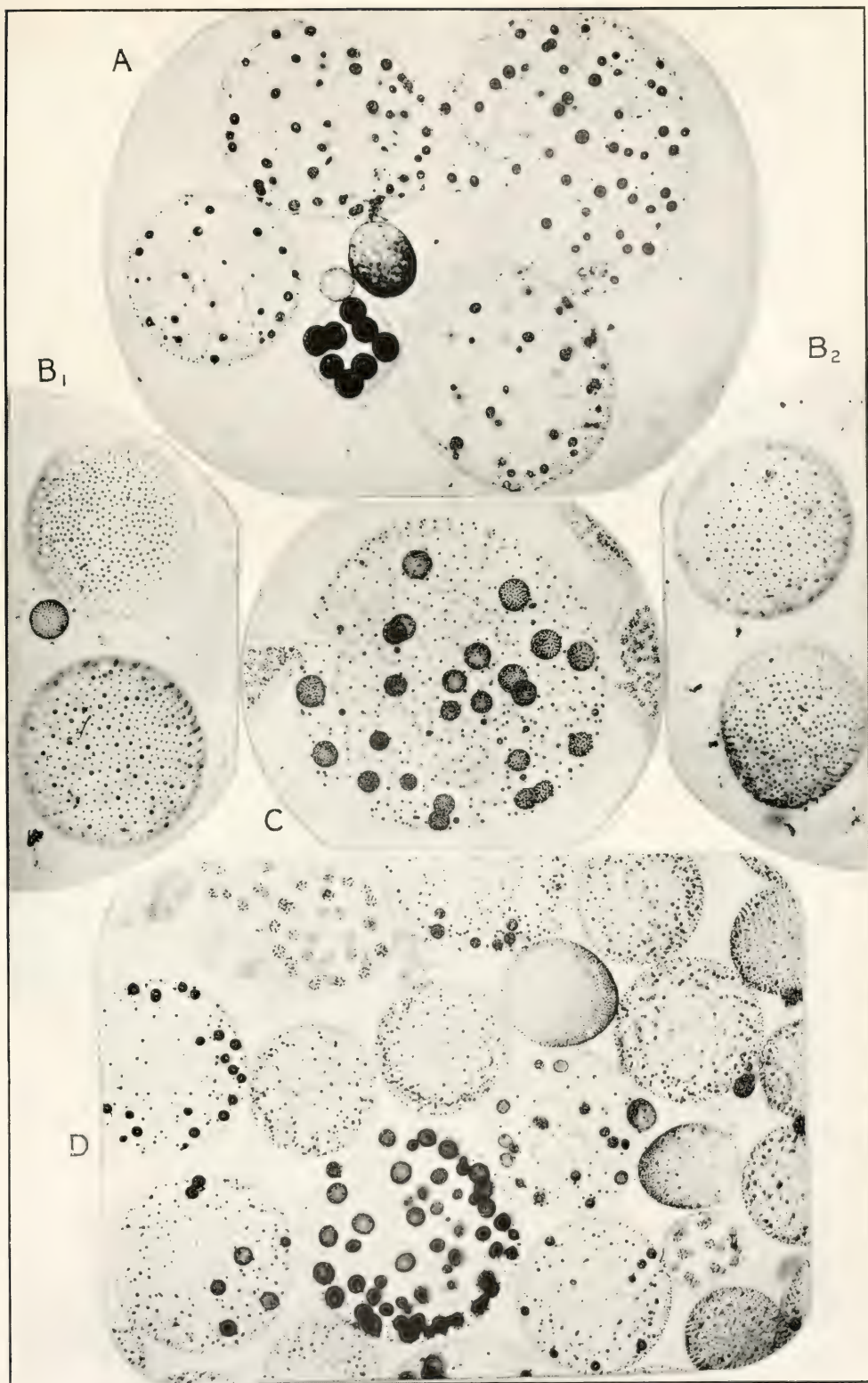
## PLATE XXXVII.

*Sphaerocystis Poweri*.

- A. Sphere containing daughter colonies entering transition stage to palmelloid condition; zoospores and young cells in peripheral layers (693).  
 B. Two colonies of the "Botryoidal Form" (683).  
 C. Cells and zoospores from a colony of the *Tetraspora* type. Larger cells mature, smaller still in groups derived from the division of older cells: on the right one zoospore shows clearly (696).  
 D, E. Transition from spherical to palmelloid form. In D the four young colonies in the centre have escaped from the colony above; on the left is a colony in which cells from the groups have divided to form zoospores which have migrated to other parts of the matrix and have there settled down and rounded off. On the right, portions of two other colonies in the transition stage (697).  
 In E, in the centre, is a typical sphere of 32 groups, some of which contain 16 and some 32 cells; round it are two transition stages and two colonies of the *Tetraspora* type showing crowding of the cells within the gelatinous envelope. Stained with iodine (704).

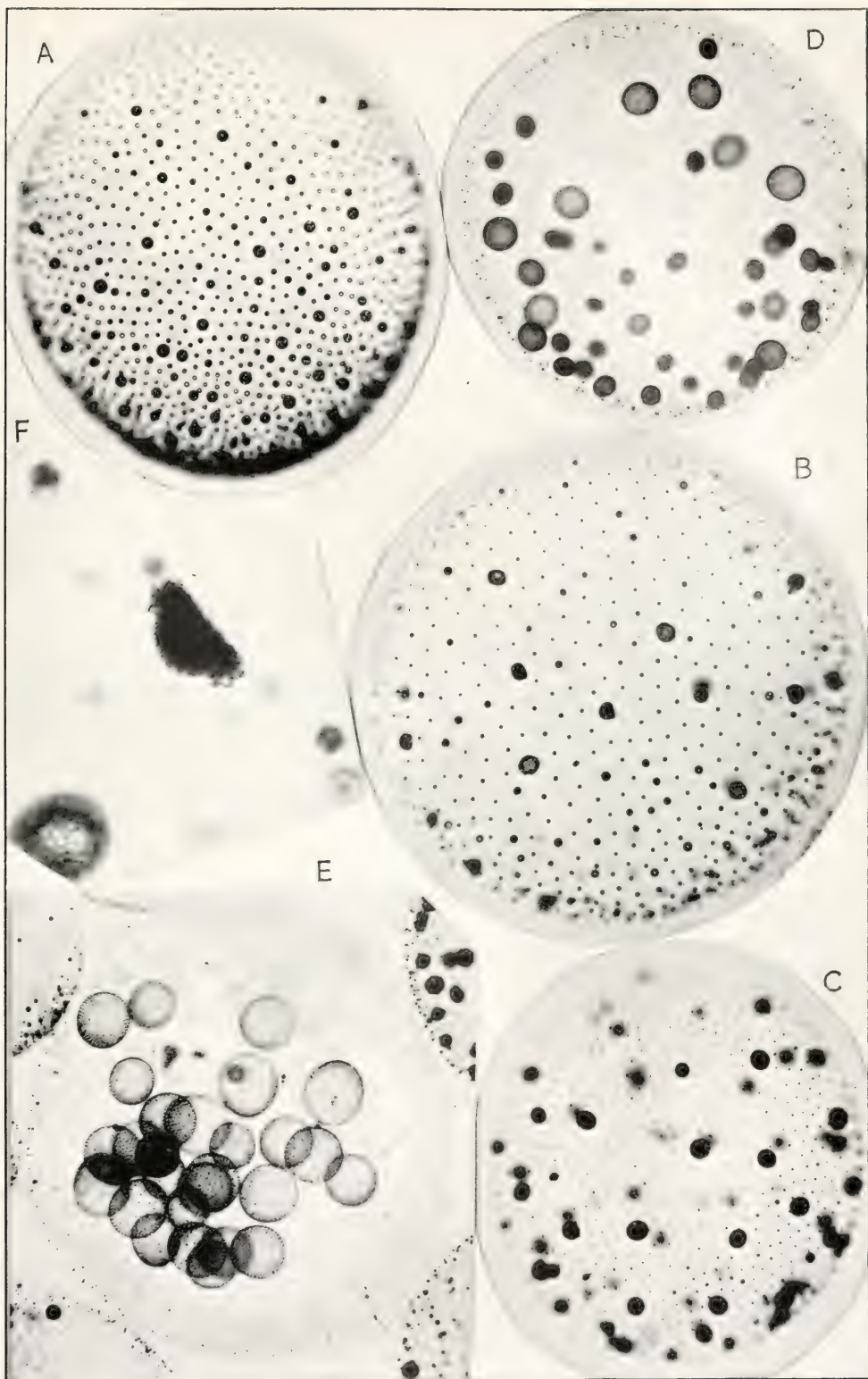
A  $\times 100$ . B  $\times 70$ . C  $\times 400$ . D, E  $\times 38$ .





VOLVOX GIGAS.

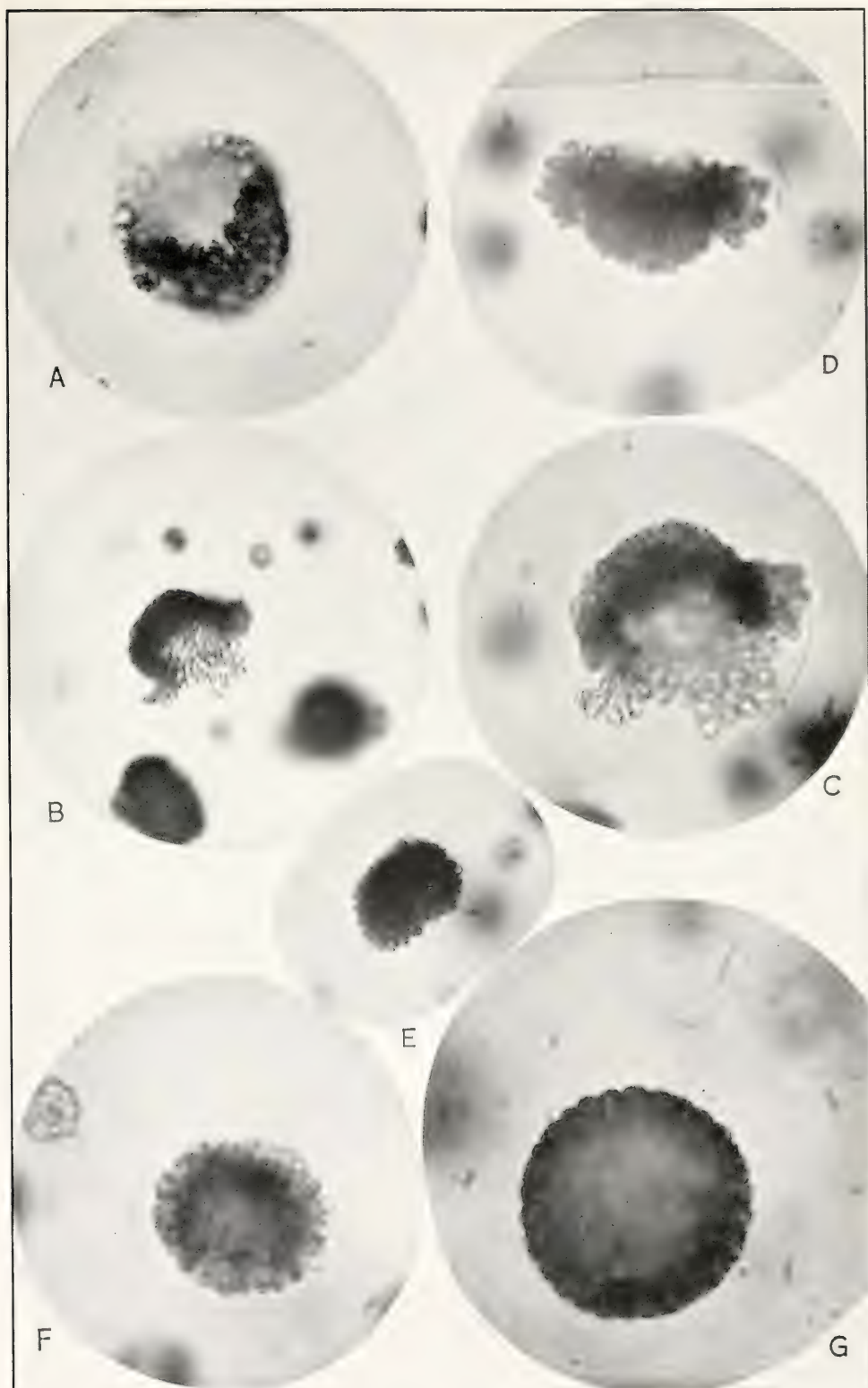




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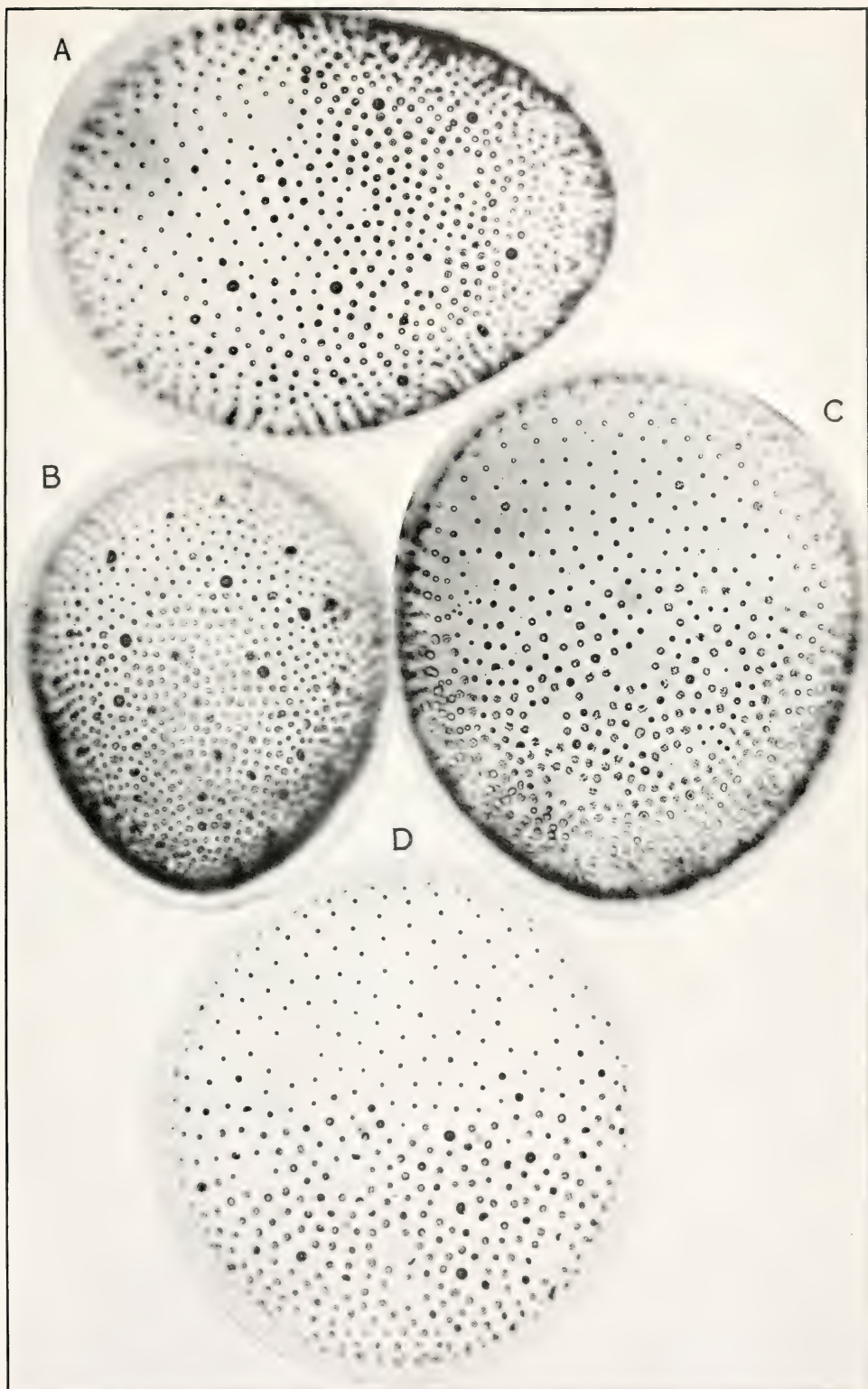






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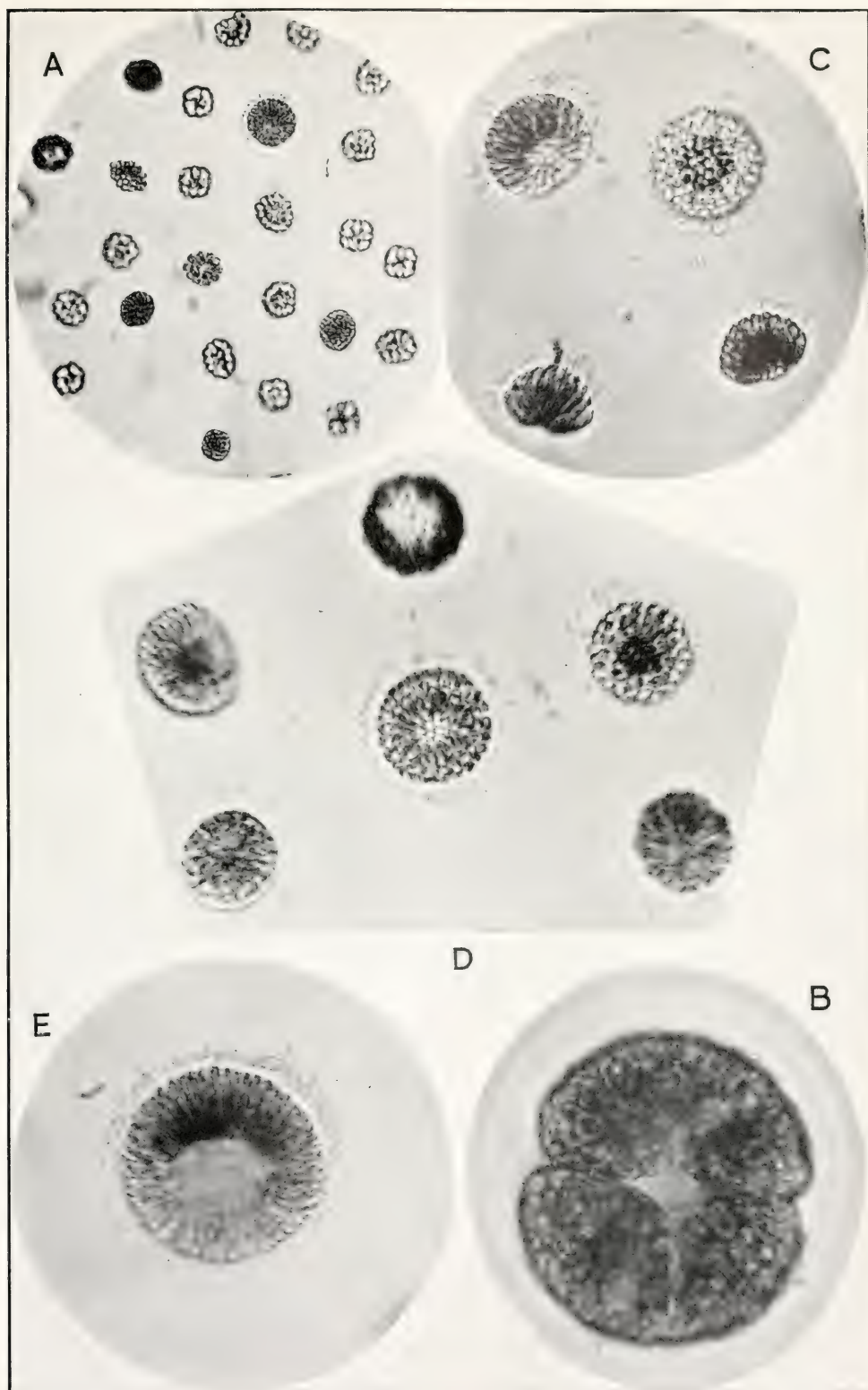




VOLVOX GIGAS.

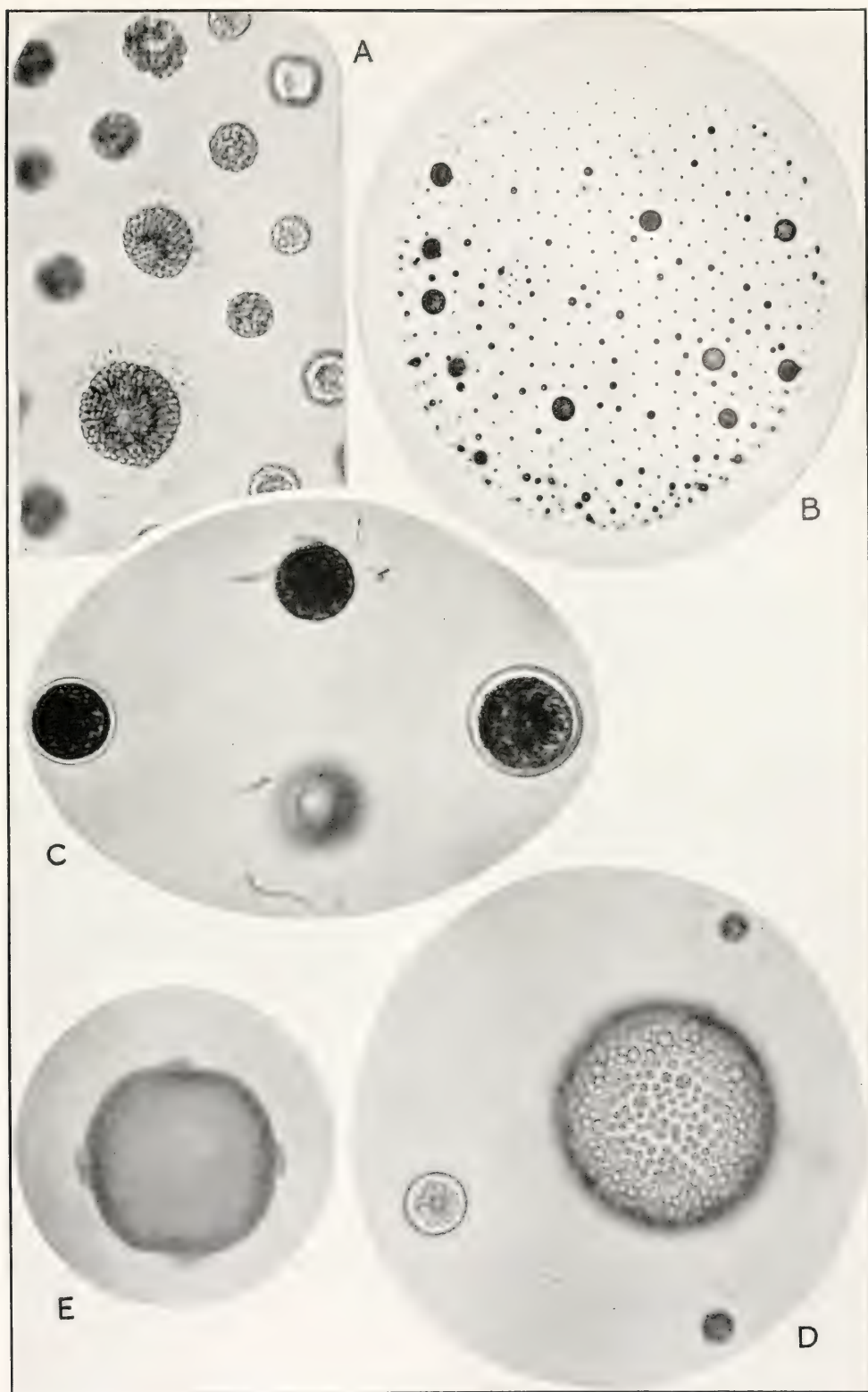






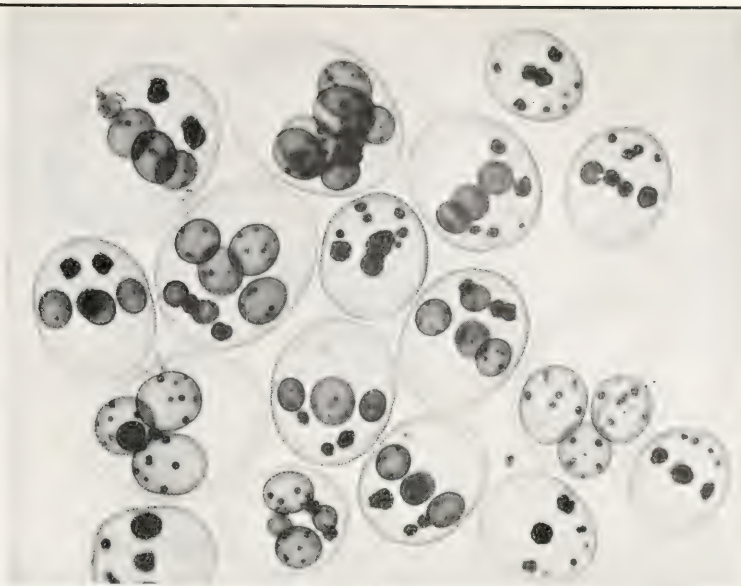
*VOLVOX GIGAS.*





VOLVOX GIGAS AND AFRICANUS.





A



B



C

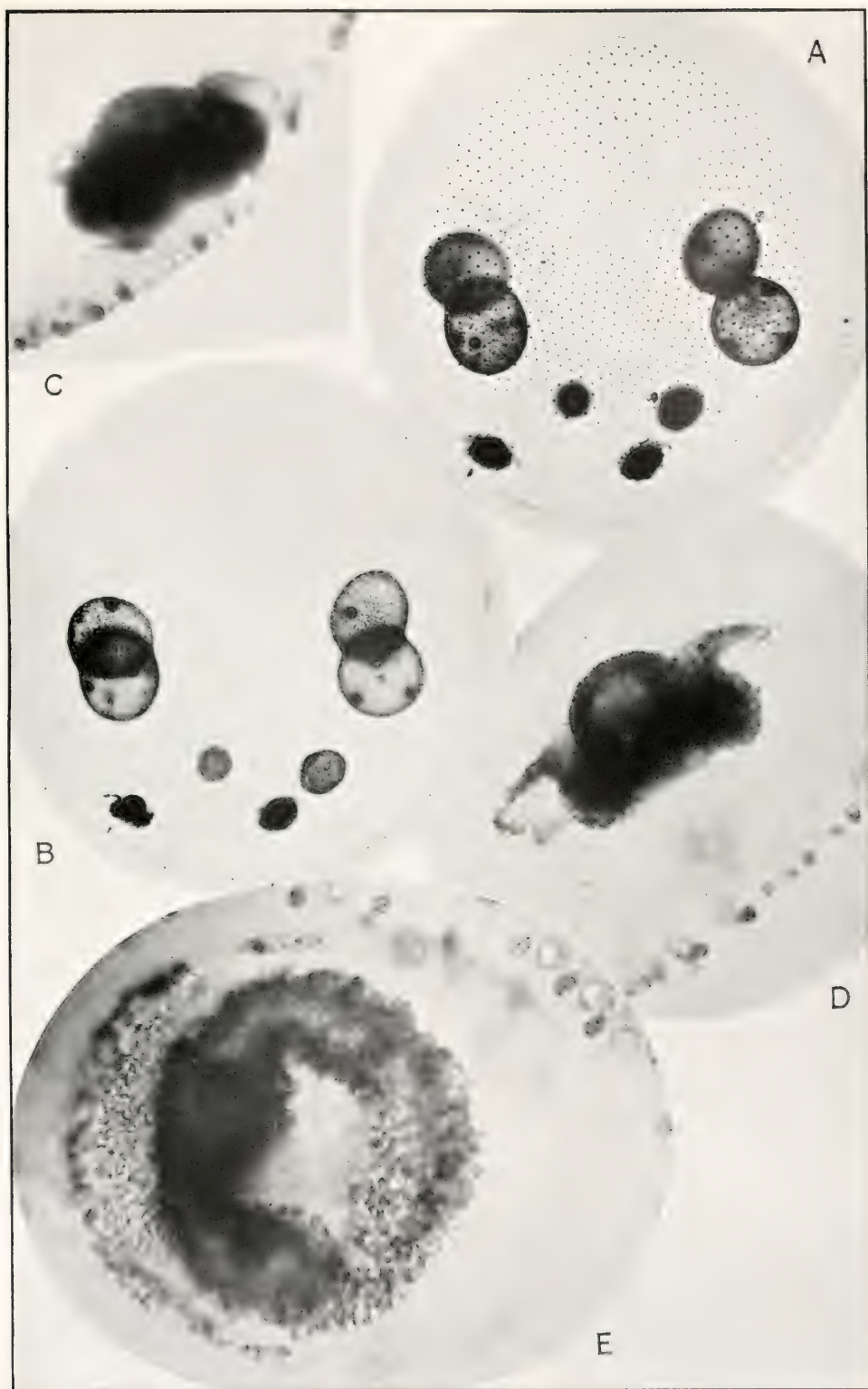


D

VOLVOX AFRICANUS.

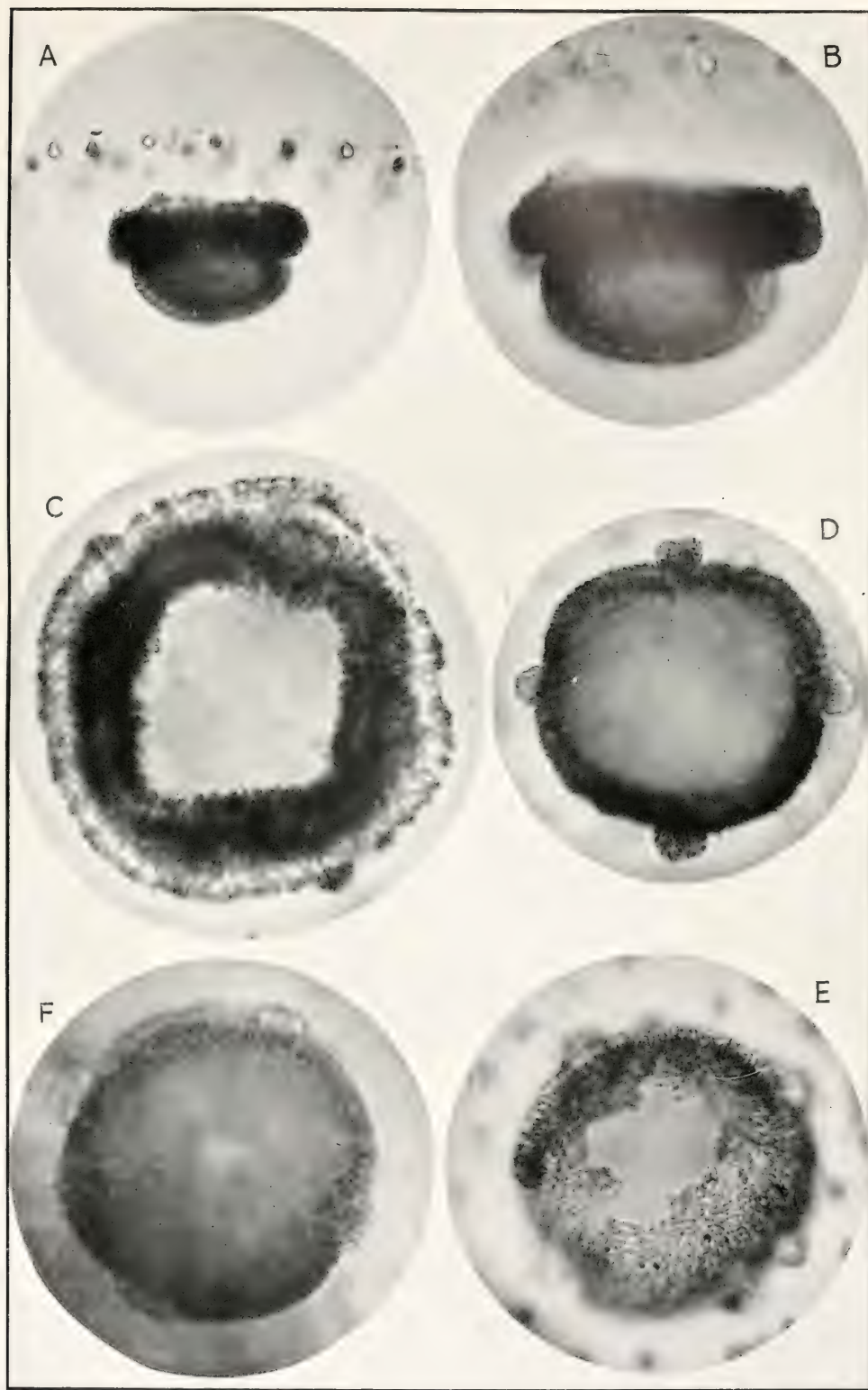






VOLVOX AFRICANUS.





VOLVOX AFRICANUS.

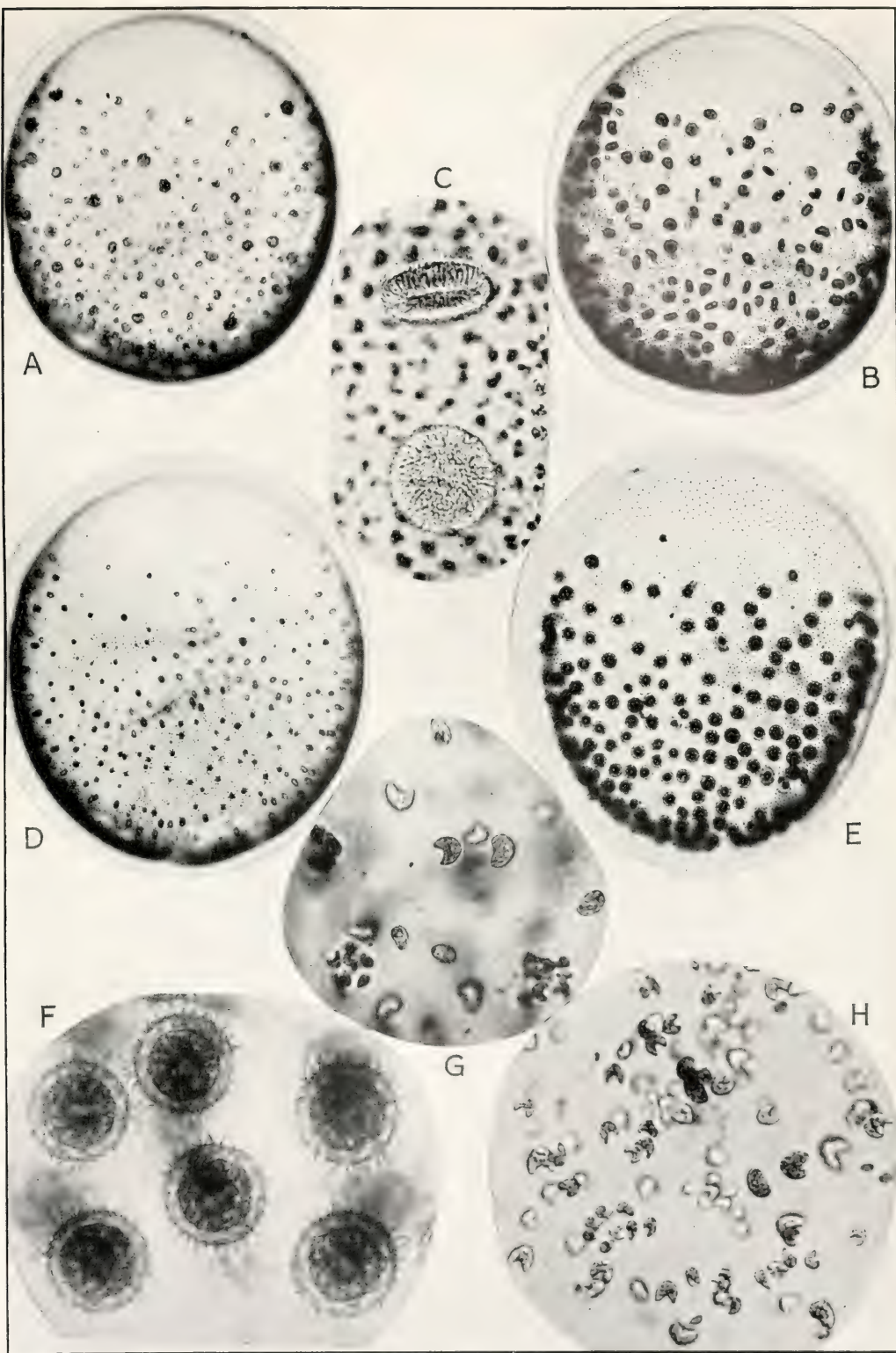






VOLVOX ROUSSELETHI FORMA GRIQUAENSIS.

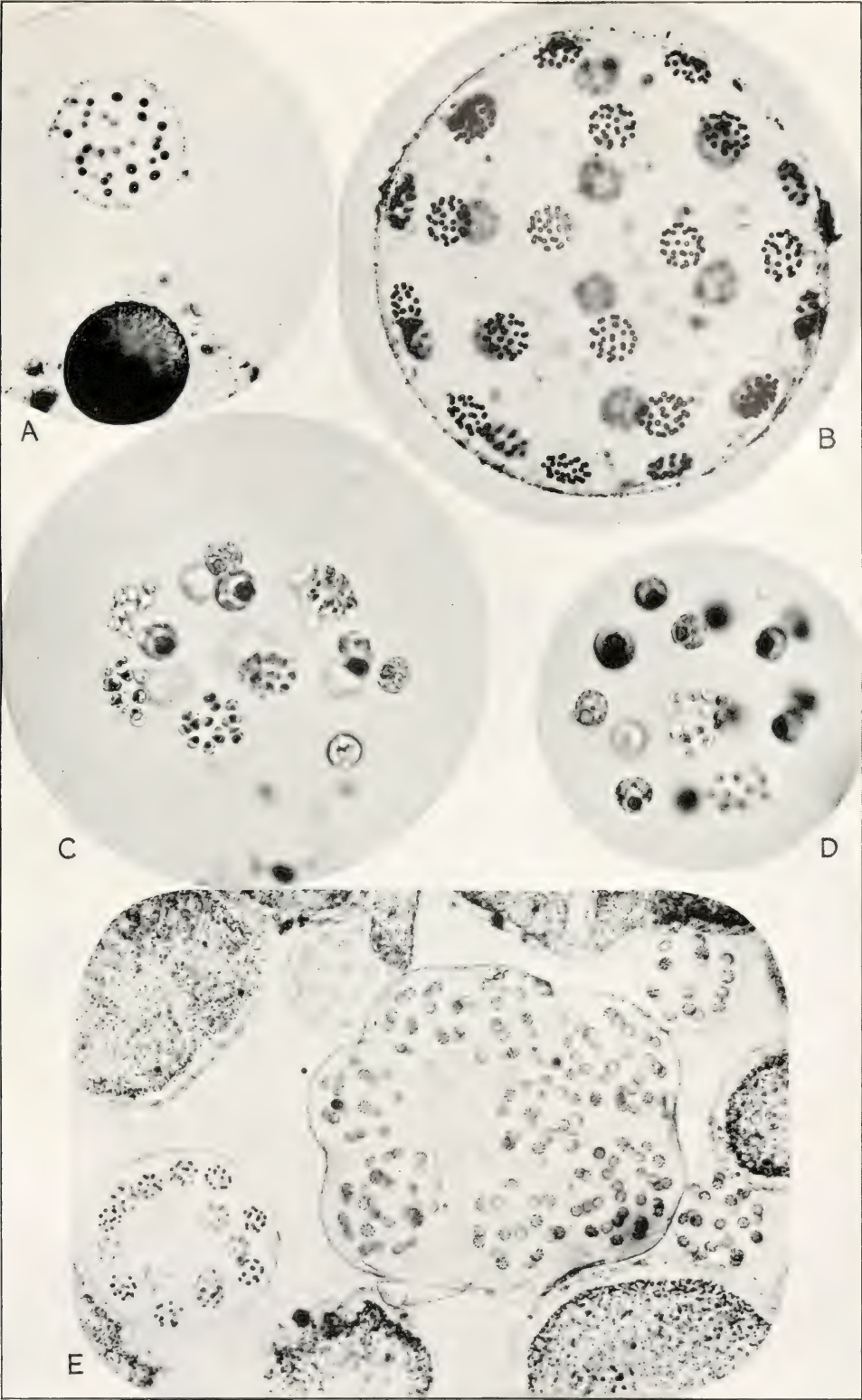




*VOLVOX ROUSSELETHI* FORMA *GRIQUAENSIS* AND *KIRCHNERIELLA AFRICANA*.



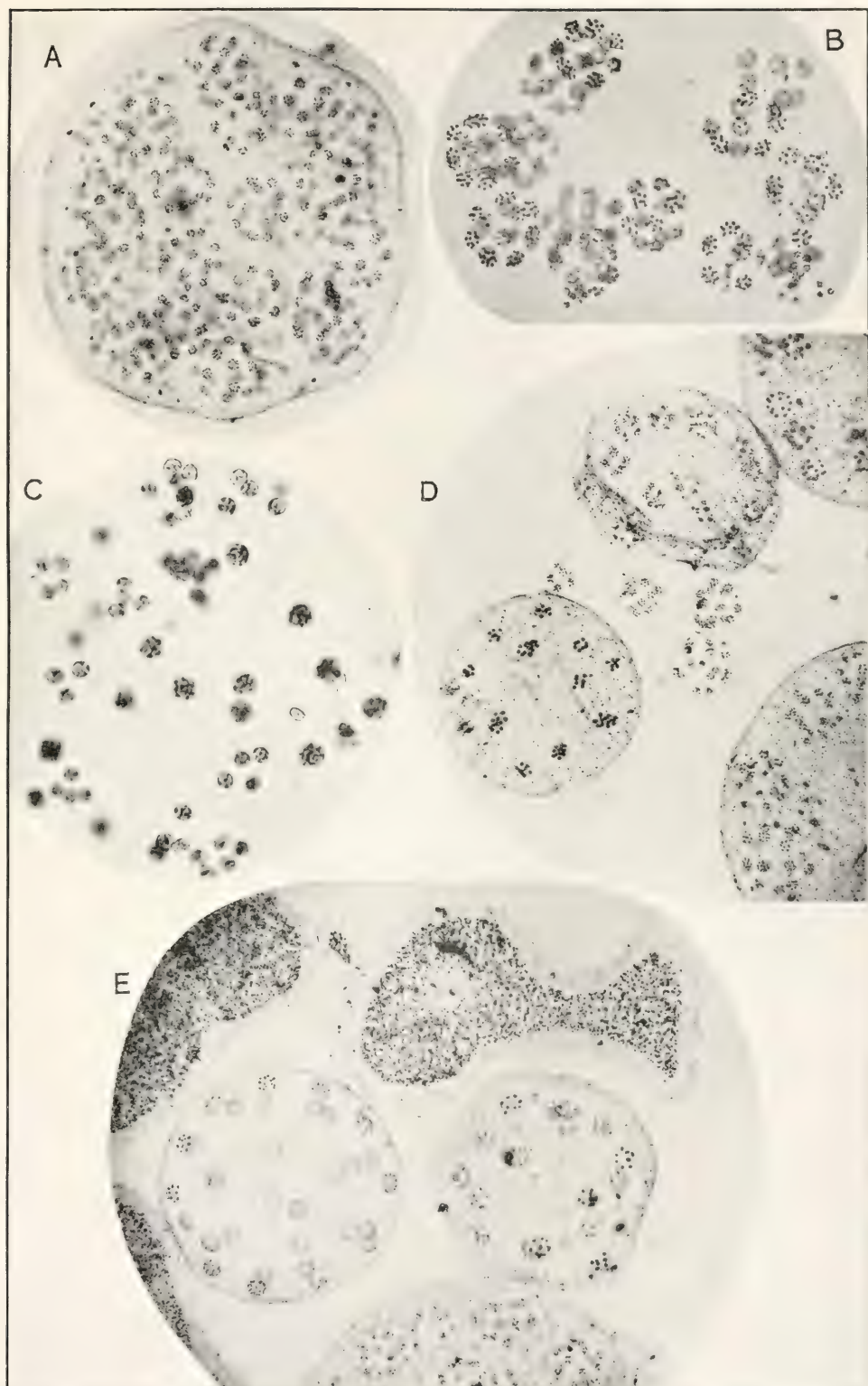




SPHAEROCYSTIS POWERI.







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5. *Volvox* in South Africa.—By M. A. Pocock, Ph.D., F.L.S.

(With Plates XXXVIII–XLIX and 10 Text-figures.)

## CONTENTS.

	PAGE
Introductory . . . . .	525
Aim and Results of Investigation . . . . .	526
Methods . . . . .	527
Occurrence of <i>Volvox</i> in Africa . . . . .	529
Habitat of <i>Volvox</i> in Africa . . . . .	530
<i>V. Rousseletii</i> and <i>V. capensis</i> . I. The Adult Form . . . . .	531
Distinguishing Features . . . . .	531
Parasites of <i>Volvox</i> . . . . .	533
Macroscopic Observations . . . . .	534
Movement; Phototactism . . . . .	535
Sequence of Asexual and Sexual Phases . . . . .	538
Observations on the Cape Flats . . . . .	539
Constitution and Size of the Coenobium . . . . .	543
The Somatic Cell . . . . .	546
1. Size of Cell . . . . .	547
2. Cell Membranes . . . . .	548
3. Protoplast, Form and Structure . . . . .	550
(i) Nucleus . . . . .	551
(ii) Chloroplast . . . . .	552
(iii) Pyrenoid . . . . .	552
(iv) Cilia . . . . .	553
(v) Eyespot . . . . .	554
(vi) Protoplasmic Connections . . . . .	556
(vii) Contractile Vacuoles . . . . .	558
Entity and Interdependence of the Somatic Cells . . . . .	559
Change in Appearance as Coenobium Ages . . . . .	559
Cell-structure compared with that of <i>V. globator</i> . . . . .	560
Reproduction . . . . .	560
Number and Arrangement of Reproductive Cells . . . . .	562
A. Asexual . . . . .	562
B. Sexual, Male . . . . .	564
C. „ Female . . . . .	565
Development of Reproductive Cells . . . . .	566
A. Gonidium . . . . .	566
Enlargement . . . . .	566
Division . . . . .	567
Period of Re-orientation . . . . .	571
(a) Preparation . . . . .	572
(b) Inversion . . . . .	574

## Reproduction—continued.

## Development of Reproductive Cells—continued.

	PAGE
A. Gonidium—continued—Results of Inversion . . . . .	577
Time of Inversion . . . . .	578
Discovery of Inversion. . . . .	579
Daughter Colony . . . . .	582
(a) Development after Inversion . . . . .	582
(b) Birth . . . . .	583
B. Male Initial Cell . . . . .	585
1. <i>V. Rousselletii</i> . . . . .	587
Enlargement . . . . .	587
Shifting of Polar Axis . . . . .	587
Division . . . . .	588
Preparation for Inversion . . . . .	590
Inversion . . . . .	592
Sperm Globoid, Maturation . . . . .	593
Escape . . . . .	594
Life Free in Water . . . . .	596
Escape of Sperms. . . . .	596
Structure of Sperms . . . . .	598
2. <i>V. capensis</i> . . . . .	599
C. Female Initial Cell . . . . .	601
Enlargement . . . . .	601
Mature Oosphere . . . . .	603
Homologies of the Reproductive Cells . . . . .	603
Fertilisation . . . . .	606
Oospore, Development after Fertilisation . . . . .	609
Size and Appearance in the Two Species . . . . .	610
Liberation . . . . .	611
Juvenile Form, Discovery . . . . .	612
Oospore Cultures ; Collection of Oospores . . . . .	614
Culture Methods and Results . . . . .	614
Germination of Oospore . . . . .	616
Zoospore, Structure . . . . .	617
Division . . . . .	620
Inversion of the Germ Colony . . . . .	622
Appearance after Inversion . . . . .	624
II. The Juvenile Form, Structure . . . . .	625
Development of Second Generation . . . . .	626
Previous Accounts of Germination . . . . .	627
Discussion . . . . .	629
1. Germination . . . . .	629
2. Form of the Germ Colony—Juvenile . . . . .	630
3. The Process of Inversion . . . . .	631
4. Variation in Number and Form of Cells . . . . .	631
5. Systematic Aspect . . . . .	632
Summary . . . . .	633
Appendix—Oospore Cultures . . . . .	636
Note— <i>Volvox</i> from Grahamstown . . . . .	638
Bibliography . . . . .	639
Description of Plates . . . . .	642



# INTRODUCTORY.

FROM the time when *Volvox* was first observed and described by Leeuwenhoek (1719, p. 149) it has been a favourite object for microscopic study, and there has sprung up an extensive literature on the genus *Volvox*, fruit of the labours of both botanists and zoologists as well as microscopists.

Nevertheless, even in such well-known forms as *Volvox globator* (L.) Ehren. and *Volvox aureus* Ehren. (= *Janetosphaera aurea* Shaw) certain points in the life-history remain obscure. Pascher (1927, p. 450, note) points out that his account of the genus can only be regarded as provisional owing to the lack of comparative studies from wide areas. Again, he emphasises the need for further investigation by means of careful fixation, sectioning, etc., but above all for numerous studies of *living* material.

That there has been a tendency to neglect the latter is well exemplified by the fact that the inversion of daughter colonies subsequent to the last cell division in the development of the gonidium was accurately described for the first time as recently as 1919 by Kuschakewitsch (1922), although it had actually been observed by Powers years earlier (1908, p. 158), and this despite the fact that if a small quantity of a well-developed, actively reproducing gathering of *Volvox* is placed in a watch-glass of water and observed for half an hour or so under a low power of the microscope, some of the daughter colonies are almost certain to show inversion, *in living material* a most striking and very easily observed phenomenon. In his critique of Kuschakewitsch's paper, Zimmermann (1923, p. 85) remarks: "The discovery (*i.e.* of inversion) shows perhaps even more markedly than the discovery of the gametophyte generation in Laminariaceae how fundamentally wrong it is to assume, even in such fully investigated organisms as *Volvox*, that the earlier investigators fully elucidated all points, even if only in the external course of development."

*Volvox* has been known from Rhodesia since 1905 (Rousselet, 1906, p. 393; and West, 1910, p. 99), from the Cape Flats from about 1915, and more recently from various other localities in South Africa. Little has, however, been done on the South African forms beyond describing them generally (as a rule from preserved material only) and recording their occurrence. No systematic observations of the behaviour and development of *Volvox* in this country have been

published, although the Cape Flats form has for some years past been collected fairly regularly during the winter months.

In February 1930 Mr. E. J. Steer succeeded in obtaining a rich growth of *Volvox* from soil brought by Miss E. L. Stephens from Rietfontein, near Johannesburg; the culture was first made in a small glass tank, later established in a large tub, whence it spread to other tubs and fish-ponds in Mr. Steer's garden at Sea Point. It has now continued to flourish in one or other of its chosen spots for over two years, for a great part of which period it occurred in very large quantities. Thus a continuous, unlimited supply of vigorous living material became available, and it seemed a good opportunity to carry out detailed observations on *Volvox*, in the hope, first, of clearing up various points as regards the identity of the South African species, and, secondly, of possibly adding to our knowledge of the genus *Volvox* as a whole. At the same time a careful study of the form of *Volvox* found in various vleis on the Cape Flats was started, and its structure and behaviour compared with those of the Rietfontein material. This was made possible in the beginning by the fact that, although the year 1930 was a very bad one for *Volvox* on the Flats in general, yet in one locality (Scanlan's Vlei, Wetton Road) *Volvox* was even more abundant than usual, while the following year (1931) there was an exceptionally good and prolonged season (May to November) for *Volvox* in most of the localities near Cape Town in which it is known to occur.

#### *Aim of the Investigation.*

The aim of the investigation, then, is twofold:

(1) To carry on a detailed observation of two of the forms of *Volvox* found in South Africa—*Volvox Rousseletii* West, as it appeared in cultures of soil from Rietfontein, and *Volvox capensis* Rich and Pocock (1932, p. 462), from the Cape Flats—more or less on the lines followed by Klein (1889 *a* and *b*, 1890), Janet (1912, 1922, 1923), and other workers in the case of *V. globator* and *V. aureus* in Europe, supplementing microscopic observation of the *living* organism with observations carried on in the field, and more detailed observation of prepared sections of carefully fixed material; and

(2) To supplement, if possible, the facts already known as to the life-history and structural details of *Volvox* in general.

*Results of the Investigation.*

Mr. Steer's material proved exceptionally favourable in many respects, and, as a result, not only has it been possible to obtain full details as regards the structure and habits of the two South African species in question, but also to extend our knowledge of the genus *Volvox* as a whole, filling up several gaps in the life-history. The most important of these are the following :—

1. Changes in the daughter colony and its component cells on completion of cell division preparatory to and during inversion.
2. Inversion of the " male colony " formed by division of the male initial cell to form the sperm globoid.
3. Formation of a *free, motile zoospore* as the result of the germination of the oospore.
4. Development of this zoospore to form a new colony, which inverts on completion of cell division.
5. Form and structure of the resultant young colony, the " juvenile " form.

*Methods.*

As already mentioned, the main investigation has consisted of detailed observation of living material. The author was, unfortunately, not successful in establishing vigorous permanent *Volvox* cultures (*cf.* Klein's observations of the capriciousness of *Volvox* in captivity : " . . . cultures, so successful the previous year . . . failed . . .," 1890, p. 2), hence visited Mr. Steer's garden at frequent intervals for *Volvox Rousseletii*, noted the amount and state of *Volvox* in the various tubs and pools, made collections of the material and examined it in greater detail as soon after as possible. In cool weather it could be kept healthy indoors for some days or even weeks, but in summer it soon became abnormal and degenerated, *cf.* again Klein (1889 *a*, pp. 45–46).

The same was done in the case of vleis on the Cape Flats ; in the collections from the latter, however, degeneration was usually more rapid, probably largely owing to the greater wealth of animal life present. In both cases, colonies of various kinds were placed in a watch-glass of water to avoid the distortion due to the weight of the colony resting on the slide (in the case of large colonies this is considerable even in a comparatively big drop of water), and measured under the microscope. Many photographs were taken of the colonies as a whole under low powers of magnification ; this necessitated the killing of the colonies to prevent movement, the method used being

usually the addition of a drop of 1 per cent. osmic acid to the water containing the *Volvox*. By the use of a Davis shutter for attachment to the microscope objective, kindly lent by Mr. Steer, additional focal depth was obtained; this was most useful in photographing the colonies in the round. Cell detail was photographed under higher powers—in many cases it was found possible to observe and photograph successfully, while actually living, single cells or groups of cells, using a  $1/12''$  oil-immersion lens. In this way a surprising amount of detail as nearly free from distortion as possible could be obtained. Further, by the use of panchromatic plates, in some cases, *e.g.* in the study of oospores, details of structure almost or completely imperceptible by the eye are recorded by the camera.

In the case of inverting daughter colonies, the pressure of the cover-slip supported on pieces of cover-slip glass keeps the parent coenobium in position without interfering with the process of inversion, so that it could be followed photographically by a series of fairly high-power photographs taken at intervals of a few minutes. The male bundles are, of course, very much smaller, and in the study of their development the oil-immersion objective (Bausch and Lomb, 1.9 mm.) was used with a Leitz 3 optical. In the process of photographing with high powers there was often considerable difficulty owing partly to the fact that the slightest change in pressure on the cover-slip may cause the object to slide slowly out of the field, but more particularly because here, as in the developing daughter colony, the whole structure and the individual cells composing it are slowly but continuously moving and altering their shape. Thus the range of possible exposure is very limited. In the case of inverting sperm bundles when the fastest available panchromatic plates were used with a powerful projector illuminant, the minimum exposure for good results was 8–10 seconds, and even this usually gave slight blurring in some parts owing to the movement of the cells (*cf.* Plates XLIII and XLIV). This, of course, applies much more to the cilia, of which in living cells only the basal, non-moving parts appear clearly in the photograph, the upper parts showing only as a blurred outer zone parallel to the surface of the colony (see Plate XIX, A).<sup>\*</sup> In addition to the photographs, careful drawings were made throughout.

Records were kept as to the state of the *Volvox* in Mr. Steer's

<sup>\*</sup> For reasons of economy, photographs and diagrams already reproduced in the former paper on *Volvox* in Africa (Rich and Pocock, 1933) are not repeated here, although referred to in the text.



various pools and in the vleis on the Cape Flats, the latter being correlated as far as possible with weather conditions.

Further, material has been fixed in various ways, embedded and microtomed to supplement the details observed in living material, particularly with regard to inversion.

Since in some respects it has been possible to follow out the life-history in the case of the Rietfontein *Volvox* (*Volvox Rousseletii*) more fully than that of the Cape Flats *Volvox* (*V. capensis*) that form will be described fully, the points in which the latter differs from it being considered as they arise. Where nothing to the contrary is stated, the account given applies equally to both species. Although much of the detail repeats the findings of earlier workers (e.g. Cohn, Klein, Overton, Janet) in the case of *V. globator* in Europe, it is given fully here, since *V. Rousseletii* and *V. capensis*, though undoubtedly very closely allied to *V. globator*, yet differ from it in many details, and it is important that they should be known in every aspect. Moreover, there is at present no recent comprehensive account of *Volvox* in English, Shaw's papers (1916, 1919, 1922, 1923) dealing more particularly with the classification of the group.

#### *Occurrence of Volvox in South Africa.*

Since the occurrence of *Volvox* in South Africa has already been dealt with (Rich and Pocock, p. 427), it will be sufficient here to give a very brief summary of the records.

Shaw (1922) has subdivided the genus *Volvox* into several new genera, retaining the name *Volvox* for that section of which *V. globator* is the type. As yet his classification has not been generally accepted in its entirety, but both Pascher (1927, p. 462) and Printz (1927, p. 58) agree that some reclassification is necessary, and the latter, while not accepting Shaw's new genera as such, uses his nomenclature to denominate subsections of the genus. Of these subgenera or subsections three have so far been recorded from Africa :

1. *Merillosphaera*, represented by *Volvox africanus* West (*Merrillosphaera africana* according to Shaw), apparently restricted in its distribution, since it has been recorded only from Lake Albert Nyanza, the Ussangu desert in Tanganyika (West, 1910, p. 102, and 1918, p. 1), and more recently from the Linyanti, where it was collected by the writer and Miss E. L. Stephens, and from Kimberley, collected by Mr. Power (Pocock, 1933, p. 492). Possibly, like



*V. tertius* in Europe, it is more widely distributed than would appear from the records, since it is fairly easily confused, particularly when young, with *V. aureus*. To this must be added the very interesting giant form also collected by Mr. Power near Kimberley, and named *V. gigas* (Pocock, *loc. cit.*, p. 480) (= *Merrillosphaera gigas* according to Shaw).

2. *Janetosphaera*, the representative of which apparently differs in no essential from the European species *V. aureus* Ehren. (= *J. aurea* Shaw), and is fairly widespread in warmer subtropical and tropical Africa (Transvaal, Zambesi, Egypt), but does not appear so far south as the Cape.

3. *Volvox*, in the more restricted sense in which Shaw uses it, which is by far the most abundant and widespread, ranging from the Cape to the Zambesi, from Tanganyika to Ovamboland, and found also in N. Africa (Egypt). It is represented by several distinct species and forms, including *V. Roussetii* West and *V. capensis* Rich and Pocock.

These three sections of the genus are sharply distinguished from one another by the form of the cell membranes. If dilute methylene-blue solution is used as Meyer (1895, p. 229) directs, the membranes and mucilaginous content of the spheroid stain purple, the protoplasts blue, and the form of the membranes can then be seen with very little difficulty. The three types of membrane found in the African species have already been described and figured (Rich and Pocock, p. 431, and fig. 1; and Pocock, pp. 481, 494, and fig. 1).

The present paper is concerned solely with *Volvox* in the narrower sense and with two species only of this section, the dioecious Rietfontein *Volvox*, *V. Roussetii*, which is apparently widespread in regions of summer rainfall, and the monoecious Cape Flats *Volvox*, *V. capensis*, which has been found at the Cape, in Rhodesia at N'gamo, and on the Linyanti, a tributary of the Zambesi. In the two latter localities it differs somewhat from the Cape form (see Rich and Pocock, p. 452).

#### *Habitat of Volvox in Africa.*

Apart from the records of *Volvox africanus* from Lake Albert Nyanza, and of *V. Roussetii* and *V. capensis* from backwaters of the Linyanti, all the records so far as can be verified are of collections from temporary pools or vleis (*i.e.* more or less extensive sheets of water formed either by rain-water collected in shallow depressions, or left by receding flood-water near rivers, as on the Linyanti), which

dry up completely for several months of the year, during which they become grass-covered flats. Even in the case of the Linyanti backwaters, it is possible that the water dries up more or less completely, since this river, like all the large tributaries of the Zambesi, is subject to very great fluctuations in water-level throughout the year.

Thus the life-cycle is dependent very largely on seasonal rainfall; moreover, as the vleis dry up and become shallower, *Volvox* is subjected to very much higher temperatures than are the European forms. At the other extreme, however, it is seldom subjected to very low temperatures, rarely if ever having to cope with even a few degrees of frost. The vleis in which *Volvox* is found may dry up very gradually, in which case it often happens that the life-cycle has been completed, sometimes more than once, and only the resting form remains, the ripened oospores being hidden in the soil at the bottom of the vlei; but very often the water dries up with astounding rapidity, and *Volvox* may be cut off at the height of its development. This occurs not only in regions of summer rainfall such as Kimberley, where the great heat causes the pools to dry very soon after formation, but also on the Cape Flats, where the beginning of summer is usually marked by the coming of strong south-east winds, which lick up the water from the remaining pools almost more rapidly. Instances of this sudden drying of the vleis will be described in more detail later.

#### VOLVOX ROUSSELETHI AND VOLVOX CAPENSIS—I. THE ADULT FORM

##### *Distinguishing Features.*

Before describing the observations on the life-history and habits of the two species of *Volvox* concerned, it will be as well to summarise the outstanding characteristics which distinguish them from one another.

##### A. *Volvox Roussetii* West (1910, p. 101, and 1918, p. 1).

The colonies are globose when young, with slightly elongated polar axis, usually becoming markedly egg-shaped when adult, the sexual colonies more so than the asexual (Plate XVIII, B, C).

The colonies are of three main types: (1) purely asexual, producing from 1 to 16 daughter colonies, most often 6 to 8 arranged alternately in two planes (Plate XX, A); (2) male colonies, producing from about one to several hundred sperm globoids; and (3) female colonies, producing from 60 to 300 or 400 oospores, average

number 180 (Plate XX, B-F). To these must be added occasional "mixed" colonies containing both asexual daughter colonies and either sperm globoids or oospores (Plate XXXVIII, B, C). Such colonies were comparatively rare in the Rietfontein material, but less so in that from Kimberley. Even rarer were female colonies with occasional sperm globoids, often somewhat abnormal, which were very occasionally seen in the latter material. The anterior pole is always free of reproductive cells, these being as a rule confined to the posterior half in the case of the asexual gonidia, to the posterior two-thirds or three-quarters in the case of the sexual cells.

At the height of its growth, under favourable conditions it is one of the largest forms of *Volvox* yet recorded, occasionally reaching a diameter of over 2 mm., though this is exceptional. In a typical healthy, well-grown strain, however, the mature asexual colonies are mostly over 1.5 mm. in equatorial diameter. The sexual colonies are in general smaller than the asexual, but even they are often over 1 mm. in diameter. The only recorded forms which exceed it in size are *V. (Besseyosphaera) Powersii* (Shaw), *Printz* (Shaw, 1916, p. 253), 1.8-2.5 mm. diameter, and the recently discovered "Kimberley Giant," *V. gigas*, which may reach the huge size of 3 mm. or over; both these species belong to different sections of the genus. In the *Eu-Volvox* section the only form which is possibly at times larger is one from S.W. Africa, *V. amboensis*, Rich and Pocock (*loc. cit.*, p. 462).

West (1918, p. 2) remarks on the marked ovoid shape characteristic of the mature sexual colonies as opposed to the "globose" form of the asexual, but all the latter shown in his photographs are still young. When mature, the asexual colonies, too, may be ovoid, though in general less elongated than the sexual individuals (Plate XVIII, B-D); the external form, however, varies greatly, being influenced markedly by external conditions.

The number of cells composing the colony is large, usually 20,000 to 30,000, though as many as 50,000 were estimated in some cases by Rousselet (1914, p. 393) and West (1910, p. 101); the protoplasts themselves are small, with well-marked protoplasmic connections, larger and more widely spaced at the anterior than at the posterior pole.

Reproductive cells are differentiated by size before birth, but undergo no divisions until some time subsequent to birth. The sperms are formed in more or less completely closed globoids, never platelets, while the oospheres ripen into spiny-coated oospores.

B. *Volvox capensis*, Rich and Pocock (1932, p. 442).

The colonies here are globose when young, and generally remain so throughout their life, even in the case of mature sexual colonies; sometimes, however, older colonies may become ovoid.

There are only two main types of coenobia: (1) asexual, with from 2 to 20 daughter colonies, but, as in *V. Rousseletii*, most often 6 to 8, arranged as in that species; and (2) sexual colonies producing from 4 to 23 sperm bundles and from 60 to 180 oospores (average number 120). The antheridium mother-cells divide very early, and the sperm bundles have usually matured and escaped before any oospheres are ready for fertilisation, so that a colony with ripe oospores appears purely female; gaps in the cell network, however, show where sperm globoids have formed and escaped.

The mature colony is somewhat smaller than in *V. Rousseletii*—adult asexual coenobia in a strong strain average about 1 mm. in diameter—and is composed of fewer cells (18,000 to 20,000). The sperm globoids are very similar to those of *V. Rousseletii*, and the oospores here, too, are enclosed in a spiny exospore, but the spines are slightly shorter and broader, while the protoplast is larger.

This species is very closely allied to *V. globator*, and is intermediate between it and *V. Rousseletii*. Further divergences in structure and development are referred to in the course of the ensuing investigation.

### *Parasites of Volvox in South Africa.*

On the Cape Flats there are two very prevalent parasites of *Volvox*. One is amoeboid, attacking and ingesting single somatic cells of either parent or daughter colonies, and often assuming strange shapes. It has been observed frequently in various localities, most often during or just after a spell of cold weather; the most marked occurrence as yet noted, however, was in the deep ditch between the road and the Wattle thicket near Dabchick Vlei (5th September 1932), where, although *Volvox* was present in very large quantities, scarcely a single healthy colony was to be found. The water of the ditch on being tested was found to have a pH concentration of 8.4, while in the neighbouring pools the water was approximately neutral (pH 7.3) and the *Volvox* particularly abundant, large, and healthy.

The second common parasite is the Rotifer best known as attacking *Volvox*—*Proales (Notamata) parasita* (Plate XIV, D); it has been found in many vleis, but in some appears to be more prolific than in others. Frequently several individuals and eggs may be seen in

one coenobium, or adult rotifers may be watched eating their way into a colony from the outside. A large proportion of the somatic cells may be eaten away before the colony ceases to move, while the developing embryos are more or less completely destroyed, or else are malformed and distorted owing to the activities of the destructive little parasites during the course of their development.

While in the case of the amoeboid parasite low temperature and high hydrogen-ion concentration seem to be predisposing causes of susceptibility to attack, in the case of the rotifer long-continuance of *Volvox* in the pool in question would appear to favour the development of the parasite, which is rarely seen early in the season. During the subsequent appearances of *Volvox* as the season advances, however, it becomes increasingly abundant. This has been noted in several vleis, particularly Scanlan's Vlei (Wetton Road) and Vlei III, near Belvedere Road.

The almost complete absence of the rotifer from the Kimberley *Volvox*—one or two individuals were noticed in some of the last collections—is confirmatory of this, since there the duration of the pool after each rain was very brief, and normally the pool dried completely between successive phases.

The crustaceans found with *Volvox* do not appear to have much power of attacking the uninjured colonies, but may apparently feed to some extent on coenobia which have been distorted or torn in some way. Very occasionally fine fungal hyphae were observed in the mucilaginous content of the hollow spheroids.

When badly parasitised, *Volvox* shows the effect macroscopically by the pale yellowish-green colour of the colonies; if this is due to the activity of rotifers, peculiarly dark opaque bodies (the eggs of the rotifer) inside the colonies may be distinguished from the young daughter colonies by the naked eye.

#### *Macroscopic Observations.*

If active living material of *Volvox* is placed in a clear glass tube and held up to the light, a number of features are distinguishable by the naked eye. In a quantity of a well-advanced strain of *V. Rousseletii* so examined, the following details may be seen:—

The colonies are a bright, clear leaf-green, swimming about actively, rotating about a polar axis which is perceptibly greater than the equatorial diameter in the older colonies, although the smaller ones appear spherical. The pole which is directed forward as the colony moves is lighter in colour than the posterior half, in which in addition



very dark green bodies can in many cases be seen. Usually the axis lies somewhat obliquely during movement, due probably to the greater weight of the posterior half. In the larger colonies the arrangement of the daughter colonies in two planes may sometimes be made out. Other colonies appear bright reddish orange—these contain maturing oospores, the red colour of which masks the green of the vegetative cells. Such reddish colonies, when present, are very conspicuous among the predominating green of the majority. Among the latter closer inspection can differentiate various types, besides those containing daughter colonies. Some are darker green and very finely punctate; these are young female colonies whose eggs have not yet changed colour. Others are lighter in colour than the asexual colonies, and they too appear finely punctate except at the anterior end—these are male colonies with sperm globoids, which are visible among the vegetative cells owing to their greater density and size, not from stronger colouring as in the case of the eggs. Finally, large, clear, nearly colourless colonies may also be seen—asexual colonies from which all the daughter colonies have escaped, or mature male colonies in which few or no sperm globoids remain. Both may continue moving slowly among the younger colonies for some time after the loss of the reproductive bodies, whether asexual daughters or male globoids, before finally degenerating.

#### *Movement.*

With the assistance of a good hand lens the movement of the coenobia may be seen to be twofold, a rotation on the polar axis and a movement forward in the direction of the anterior pole, which is in general directed towards the light. In addition to the colonies which are actively moving, it is usually possible to see others in which the voluntary movement has ceased, and which are as a consequence slowly dropping downwards through the water, the heavier posterior end always lowest.

The rotation on the axis is not always in the same sense. In favourable material, the majority of the coenobia can be seen to be rotating in a clockwise, others in a counter-clockwise, direction. If one colony be singled out for observation, it may often be seen to pause momentarily in the rotatory movement and to resume in the opposite sense. Janet (1912, p. 133) and Klein (1889, p. 168) observed the same behaviour in the case of the European *V. globator*.

If active material be placed in a watch-glass with plenty of water

and lighted strongly from one side, the colonies can be watched swimming towards the light; in a very short time all the colonies are collected on that side of the glass nearest the light, moving about and jostling one another. This is specially marked if the material has been kept in the dark or badly lighted for some time previously. In half a minute practically all the colonies have passed to the side nearest the light. Reverse the position of the light without moving the watch-glass, and the colonies immediately start in the opposite direction, again collecting on the side nearest the light. This gives an average rate for the crowd of about 6 to 8 cm. per minute, but some individuals obviously attain a much higher speed (*cf.* also Klein, 1889, B, p. 47, for *V. globator*).

From a few such simple experiments it becomes obvious that *Volvox* is strongly phototactic, and that in this pursuit of light the anterior pole is directed towards the light; it would thus appear that this pole is the light-sensitive region of the coenobium.

Under natural conditions, of course, the upper surface of the pool is the most strongly lighted, hence during its voluntary movement *Volvox* tends to swim upwards and collect in the upper layers of water. In the watch-glass experiment, however, if the one-sided illumination continues to operate for a lengthened period, there comes a time when the stimulus is no longer effective, the colonies cease to respond, become quiescent, and gradually sink under their own weight, collecting at the bottom of the glass. Similar behaviour may be seen in their natural surroundings; after remaining motile near the surface for some time, if the light is strong, the coenobia soon become quiescent, and slowly sink. Possibly this may be a question of "fatigue," the cells ceasing to respond if the stimulus is long continued. However that may be, the alternate swimming towards and dropping away from the light is probably directly connected with photosynthetic activity—during exposure to light carbohydrates are actively formed, accumulate in the cell until a certain concentration is reached, when active movement ceases and the plants slowly sink under their own weight. Further, it would appear that the stimulus of light is necessary to initiate the movement of the cilia, since at night the colonies collect at the bottom of the vessel containing them.

Interesting observations on the vertical distribution of *Volvox* in deep waters at different times of the day were carried out on Lake Monona, Wisconsin (Smith, 1917), but conditions there are, of course, very different from those obtaining on the Cape Flats. Further

observations of the response of *Volvox* to light, carried out in the field or with large tub cultures imitating as far as possible natural conditions, might prove very instructive in this connection. Considerable difficulty, of course, attends such work in the field, and so far experiments on phototropism in *Volvox* have been mainly confined to the laboratory. The most detailed are those carried out by Oltmanns (1917, p. 280), who attributes the sinking during the quiescent period to geotaxis. This certainly seems sufficient explanation for this part of the process; even in preserved material, if the tube containing it is shaken up and then left to settle, the colonies can be seen dropping slowly, the axis often slightly oblique, but the posterior pole, which with its closely packed somatic and numerous reproductive cells is undoubtedly the densest part of the coenobium, always on the under side. The specific gravity of the living colony is evidently a little higher than that of the surrounding water.

The movement was most beautifully seen on a large scale one morning of February 1931. On that date Mr. Steer's fishpond\* was particularly rich in *Volvox*—the strain inhabiting it was almost at its optimum development—the clear water in the centre of the pool being green with *Volvox*. To the north of the pond is a fernery protected by a roof of wooden slats an inch or so apart. The morning sun shining on this roof threw its shadow on the water, making alternate bars of light and shade. In each bar of light was a column of moving green spheroids swimming upwards and moving about near the surface, jostling one another as they moved. The light reflected from the countless moving bodies gave the bars of light a scintillating appearance, like motes in a ray of sunshine, most striking even at a distance, while the bars of shadow, on closer examination, were found to be practically free of *Volvox*. Among the mass of upward-moving bodies others could be seen slowly sinking without other movement.

In the field it is seldom possible to observe the movement so well. To begin with, at the Cape at any rate, there is seldom such a quantity of *Volvox* in so small a space, and, further, conditions are much less favourable for observation. Still, when *Volvox* has been particularly abundant on the Flats, it has sometimes been possible, by wading out into the middle of the pond and watching carefully, to see similar

\* A cement pool about 6 by 8 feet in area, 4 to 6 inches deep at one end, 2 to 3 feet at the other, with various water plants, Arrowhead, *Cyperus*, *Limnanthemum*, etc., growing round the edge, the centre fairly clear, inhabited by tame frogs, small fish from the Flats, and so on.

behaviour in the case of *V. capensis* in both the Ottery and Wetton Road vleis.

Henneguy (1876, p. 288) states that in *V. aureus* the mature female colonies exhibit negative phototropism, actually swimming away from the light. This has not been observed in the case of the African species; indeed, colonies red with ripening oospores have been watched joining in the mass movement, but as they grow older their activity decreases and they tend to collect at the bottom of the water. But when watching a dish of *Volvox* brought into the light it is obvious that the horizontal movement is not invariably directly towards the light. Some colonies at first swim in other directions, occasionally even directly away from the light; eventually, however, all become similarly orientated, and move towards the illuminant.

#### *Sequence of Asexual and Sexual Phases.*

In both *V. Rousseletii* and *V. capensis* the appearance of the various types of colonies, provided external conditions are favourable, follows the same sequence:—

1. *Asexual Phase*.—Soon after rain has fallen and pools have formed—if the weather is warm, within four or five days—"Juveniles," resulting from the germination of oospores, appear (Plates XLVII and XLVIII). They are quickly replaced by normal asexual colonies, which by the third or fourth generation have the full complement of cells and sometimes a large number of daughter colonies (*cf.* Plate XVIII, A). This asexual phase may be prolonged, all the daughters produced being themselves asexual, or it may be short and soon succeeded by the sexual phase, the duration apparently depending to a great extent on the temperature.

2. *Sexual Phase*.—The sexual phase begins with the appearance among the asexual colonies of occasional sexual individuals; the proportion of sexual to asexual colonies rapidly increases, until the former may actually outnumber the asexual colonies, which are, however, always present (Plate XVIII, B). In *V. capensis* the number of sexual colonies is relatively smaller than in *V. Rousseletii* (Plate XII, D). In the latter, at the beginning of the sexual phase, male colonies are often present in large numbers, sometimes outnumbering the female colonies. Usually, however, the latter predominate, while, as the phase advances, the number of male colonies falls rapidly (Plate XVIII, B). It is usually at this stage that mixed colonies occasionally appear; in *V. Rousseletii* these contain asexual



daughters and either sperm bundles or oogonia (Plate XXXVIII, B, C), while in *V. capensis* both kinds of sexual organs are usually present. As the sexual phase advances in *V. Rousseletii* coenobia containing ripe or nearly ripe oospores may actually predominate, whereas in *V. capensis* the proportion of such colonies is always relatively small; very few colonies red with ripening oospores are, as a rule, found at one time.

3. *Second Asexual Phase*.—After a longer or shorter time sexual activity begins to wane, the proportion of asexual colonies again increases, and finally all sexual colonies disappear. Sometimes, as this phase advances, *e.g.* in the Rietfontein cultures, there is a marked diminution in the number of daughter colonies formed in each coenobium; as few as two, or even one, may be formed. Often, too, the colonies are smaller and composed of fewer cells (Plate XVIII, D). This is, however, not always the case, and is probably affected to some extent by external conditions.

#### *Observations on the Cape Flats.*

From observations made on the Cape Flats in 1931, it was suspected that in *Volvox capensis* at any rate there might be several successive phases during the seasonal existence of any one vlei, but the observations made were not sufficiently detailed to confirm or refute this. In order, therefore, to obtain further evidence on this point, during the season May to November 1932 attention was concentrated on the chain of vleis running parallel to Belvedere Road, Claremont. These vleis were visited regularly at intervals of a few days throughout the greater part of this period, and the occurrence of *Volvox* noted in various parts. As a result several interesting facts emerge :—

(1) The appearance of *Volvox* is extraordinarily local—it may be swarming in one part of the vlei and absent from other parts. This is entirely independent of the direction of the wind. Possibly the phanerogamic and larger algal flora may to some extent prevent the spread of *Volvox* from one part of the vlei to another, but as the same phenomenon was noted in an extensive open stretch of water with scarcely any such vegetation, it seems more probable that the horizontal range of *Volvox* is very limited. If it is found at one particular spot in the vlei it is because it has developed at or very near that spot.

(2) In every case it was found that *Volvox* disappeared and reappeared several times (most often thrice) during the season. The



length of the periods during which *Volvox* was present in any one vlei or part of a vlei varied from two to six weeks, most often lasting for from three to five weeks. The time elapsing between disappearance and reappearance at the same spot likewise varied; usually periods of from one to two weeks during which no *Volvox* could be found separated each two successive phases, but in one vlei on one occasion *Volvox* disappeared for as long as five weeks. In the latter case the prolonged disappearance was both preceded and followed by comparatively lengthy (four and six weeks respectively) periods of great activity, during which large numbers of oospores were produced.

(3) "Juvenile" colonies, resulting from the germination of oospores, were collected at the beginning of the season only. Judging from observations made elsewhere (notably near Kimberley), the obvious explanation of the reappearance of *Volvox* after each total disappearance is, that some of the oospores formed during the previous phase ripen quickly and germinate at once without undergoing a period of drying, and it was hoped that this would be demonstrable by the presence of Juveniles at the beginning of the successive phases, but none were found.

Nevertheless, the failure to detect Juveniles cannot be regarded as proof of their absence. So far, whenever Juveniles have been collected, it has been soon after the pool has formed (3 to 5 days) and usually while it is still small. Hence, firstly, the many oospores dormant in the soil have all, after a period of dryness, been suddenly re-immersed in water under the same conditions, and it is only to be expected that large numbers would in such circumstances germinate simultaneously, whereas when oospores germinate without previous drying it is probable that germination is sporadic, spread over a longer time, and depending in part on the age of the various oospores. Secondly, the very small size of the Juveniles (about that of large *Eudorina* colonies) must be taken into consideration—in larger expanses of water the difficulty of collection and detection is enormously increased unless they are present in very great numbers.

The present field observations then can only be taken as showing that several successive growths of *Volvox capensis* may occur in a given piece of water during the season. The probability is that this is due to the germination of oospores formed during the preceding phase, of which some at least may undoubtedly germinate without previous drying, but more exact investigation is necessary to prove it, since so far field observations give negative results. The difficulties

of exact observations in the field are obvious, and so far the Flats *Volvox*, unlike the Rietfontein one, has proved peculiarly intolerant of culture conditions.

Incidentally, observations of *Volvox* in Africa suggest an explanation for the non-observance of Juveniles in *V. globator*—it seems that these are formed in large numbers at one time, only when rain has fallen and refilled the pool after a dry period, and that when oospores germinate without drying, germination is much more sporadic. Consequently the number of Juveniles present at any one time is comparatively small, and their presence proportionately difficult to detect.

Observations on external conditions, in particular temperature and hydrogen-ion concentration of the water, were carried on side by side with those on *Volvox*. Here again more extensive observations are necessary before it is possible to arrive at definite conclusions. At present, however, the following facts seem to be fairly well established :—

1. *Effect of Temperature.*—Other conditions being favourable, comparatively high temperatures are conducive to increased rapidity and extent of development. The most luxuriant growths of *Volvox* on the Cape Flats have always coincided with warm, bright weather. In May 1931 a spell of unusually hot weather at the beginning of winter, immediately following good rains which had caused the formation of small pools, resulted in a very rich crop of *Volvox*. Again, in November of the same year, one of the richest growths of *Volvox* as yet observed on the Flats occurred in Belvedere Road Vlei III, when the temperature of the water at midday was over 90° F. on several successive days. In 1932 there were no very warm spells during the winter; in the vleis under observation *Volvox* was never very abundant till well on in the season when, with warmer weather, there came a succession of very rich crops in several pools—e.g. De Klip, Belvedere Road Vlei III and parts of Vlei II.

2. *Hydrogen-ion Concentration.*—At the Cape the water of those vleis and ditches where *Volvox* occurs is always either approximately neutral or slightly on the acid side, the pH ranging from 6·5 to 7·3, most often from 6·7 to 7·0; on the other hand, the pools producing *Hydrodictyon* are almost always on the alkaline side, pH 7·6 to 9·0, and very rarely are the two algae found in the same vlei. Occasionally *H. africanum* and *V. capensis* occur together, e.g. in the Wood pool next to Dabchick Vlei, but so far the writer has never found *Volvox* associated with the second form of *Hydrodictyon* (*H. indicum*?) which occurs on the Flats. On one occasion, in a

ditch at the side of the road near the farm Vaderlandsche Rietvlei, a very rich growth of the latter *Hydrodictyon* was found, the pH of the water being 8.3. A mile or so along the road *Volvox* was abundant in the ditch, while *Hydrodictyon* was not present, the pH here being 7.3.

Even more striking is the case of De Klip, a granite outcrop in the Flats. The granite forms a ring of fair-sized bosses round which is a chain of small pools, while two larger pools lie between the granite bosses. The former, in which the pH ranged from 6.7 to 7.3, yielded fine crops of *Volvox* and no *Hydrodictyon*, while the position was reversed in the inner pools where the pH was 7.6 to 8.5; here only a few yards separated the pools.

The one exception to this rule as to the acidity of the water inhabited by *Volvox* is that already mentioned as occurring in the ditch near Dabchick Vlei (p. 533), which was accompanied by pathological symptoms in the *Volvox*. On other occasions the pH of the water from this ditch was that normally found in *Volvox* pools, and the colonies were quite healthy.

It was thought that changes in the hydrogen-ion concentration might possibly have some connection with the periodic disappearances of *Volvox*, but so far the observations made do not support this theory. The fluctuations in the pH of any one pool throughout the season were comparatively small; for example, in Belvedere Road Vlei III A, from May to November the pH ranged from 6.4 to 7.1, the neutral point being approached five or six times during the season, always after heavy rain. In the main pool the range was similar, although even when the two pools were continuous the pH values of the two were seldom identical. In Vlei II the pH ranged from 6.5 to 7.2, in Vlei I (Ackerman's) 6.4 to 7.4, while the remaining *Volvox* vleis all gave similar values.

So far, then, observations of external conditions offer no full explanation of the termination of a growth phase in *Volvox*. Occasionally it is possible to point to unduly high temperature as a possible cause, but the probability seems to be that there is an inherent time-limit to the duration of the alga, at any rate in South African waters under natural conditions. Probably the duration of any one phase is modified by external factors, but these are only secondary in their effect. Given favourable conditions, the *Volvox* oospores germinate, a brief asexual phase is followed by a sexual one, and this in turn by a second asexual phase which may continue for a shorter or longer time, but ultimately ends, and the alga disappears

completely, until germination of oospores again initiates a period of activity. If a rise in temperature coincides with a period of renewed activity, then the greater warmth is beneficial, speeding up the life-processes and resulting in a specially rich growth both as regards numbers and size of individual colonies.

Mainx (1929, p. 205), working with cultures of *V. aureus* in earth-decoction, found that slight changes in temperature or alkalinity of the culture medium might hasten the onset of the sexual phase, but that in general low temperatures delayed it. The observations made on the Cape Flats suggest that the same would apply to *V. capensis*.

Very often, of course, the time-limit is determined by the drying up of the vlei. For instance, in 1931 a vlei near Ottery Road, Wynberg, was under observation. *Volvox* was in good condition, the vlei containing plenty of water, when a south-east wind sprang up and continued for some days, sweeping across the flats and licking up the water in all the unprotected vleis. The vlei was visited on Monday, 2nd November; the south-easter was blowing lightly, the vlei, though low, was continuous. Two days later (4th November) at 6 p.m. it was again visited; the south-easter, though still not very strong, had been incessant, and the vlei was reduced to a few isolated pools, very rich in *Volvox* in beautiful condition (sexual and asexual), and swarming with tadpoles, mayfly and dragon-fly larvae, and minute fish, probably the young of the Cape minnow (*Galaxias punctifer*). By 11 a.m. next day even these pools had disappeared, and save for two or three patches of churned-up mud and dying tadpoles no free water remained. Yet the previous day *Volvox* was at the height of its development.

However, before attempting a complete solution of the problem of the behaviour of *Volvox*, detailed observations over long periods are necessary, not only observations of *Volvox* itself, but also of the organisms associated with it, the changing composition of the surrounding medium, its hydrogen-ion concentration, temperature, and weather conditions in general, in relation to its occurrence in Nature, supplemented by carefully controlled culture experiments.

#### *Constitution and Size of the Coenobium.*

As in *Volvox globator*, *V. Rousseletii* and *V. capensis* are built up of a very large number of cells arranged in a single layer round the periphery of a hollow, prolate spheroid.



Each cell consists of a relatively small protoplast occupying the outer third to two-thirds of a prism bounded by delicate cell membranes. The membranes forming the ends of the prism are slightly convex, and are fused to form continuous outer and inner membranes, the space between which is divided up into polygonal prisms by the fused side-walls of adjacent cells (fig. 1, A-D). The hollow of the spheroid is filled with a mucilaginous liquid.

#### *Size of the Coenobium.*

The range in size of the colonies is very great. If a small quantity of *V. Rousseletii* material is examined, all sizes from very young colonies recently liberated up to senile colonies approaching their end are seen. But apart from this, even among adult colonies, *i.e.* asexual colonies with rotating daughters about to escape, male colonies in which the majority of the sperm globoids have already been liberated, or females with ripe oospores, there is considerable diversity in size. *Mature* asexual colonies range from  $601 \times 687 \mu$  (in a vigorous strain, smaller in one which is growing weak) to  $2037 \times 2100 \mu$ , while colonies of over 1.5 mm. are common. The sexual colonies never reach quite such a large size, but even they may attain over 1 mm. diameter.

In *V. capensis* the colonies are smaller, mature asexuals ranging from  $495 \times 540$  to  $1250 \times 1292 \mu$ , colonies of 1 mm. diameter being common at the optimum, while sexual colonies again are slightly smaller, ranging up to  $1077 \times 1098 \mu$ , average size  $820 \times 860 \mu$ . In the Rhodesian form the size is somewhat greater.

#### *Number of Cells constituting a Coenobium.*

The number of individual cells is very great, always several thousand, except in the Juvenile formed from the germinating oospore, but here too the limits within which variation is possible are wide.

In *V. capensis* the range is from 9000 to 23,000, the average in a strong strain lying between 18,000 and 20,000.

In *V. Rousseletii* the number is slightly greater, ranging from 14,000 to 42,000, the average lying between 20,000 and 23,000. West (1910, p. 101) and Rousselet (1914, p. 393) place the upper limit at about 50,000, but in the Rietfontein material such a high number was never found.

The methods used in counting were mainly two: (1) Estimate the



surface of the colony, regarding it as a sphere of diameter equal to the mean diameter of the spheroid, divide by the area of the cell regarded as a regular hexagon; result, the number of cells in the coenobium. Obviously this method is only very approximately correct; the diameter of a cell and that of the spheroid are quantities of a different order of magnitude, and the measurement of the former can only be approximate with the means at one's disposal, the probable error in proportion to the size of the diameter being consequently very high. Further, the size of the cell varies in different parts of the coenobium.

(2) The second method, based on the same considerations, has been reduced to a formula by Janet (1912, p. 28): the square of the number of cells seen on a great circle multiplied by  $\cdot 367$  gives the total number of cells composing the colony. This should give comparatively more accurate results, but here too the percentage of probable error is high, since, owing to the great number, it is by no means easy to count the cells round the edge of the colony accurately.

Theoretically, since the colony is held to arise by successive simultaneous bipartitions from a single mother-cell (the gonidium), the resultant number of cells should always be a power of two. Zimmermann (1921, p. 260, note 2), in the case of *V. aureus*, states: "The cells of a colony divide constantly simultaneously, and in a healthy culture degenerating cells scarcely occur." And again (1925, p. 397, and note 3): "Die Furchung . . . ist eine fortgesetzte synchrone Zweiteilung sämtlicher Zellen," adding to this a note that, according to older statements, from the 8-celled stage onwards a part of the cells may no longer divide.

This statement may be correct as regards *V. aureus*, where the total number of cells is 4096 at the outside, often as few as 1024. In the case of the *globator* section, however (*Eu-volvox*), the number of cells in question is very much higher, and in the two South African species at any rate there are indications that the cells do not all divide simultaneously, that in a division some cells may fail to participate without in any way degenerating, sometimes merely missing a division. Further, in *V. capensis* the gonidia are clearly differentiated before the daughter colony inverts, and always have at least two pyrenoids. The conclusion seems obvious that they are cells which have not taken part in at least the last, probably several cell-divisions (fig. 1 E).

If Zimmermann's statement were invariably correct, the possible numbers of cells, including the reproductive cells, would be four only,

viz. 8192 ( $2^{13}$ ), 16,384 ( $2^{14}$ ), 32,768 ( $2^{15}$ ), and 65,536 ( $2^{16}$ ), since no observer yet has computed more than 50,000 cells per colony. Even allowing a large margin of error in counting the cells, these numbers scarcely cover all observed variations. Irregularities in division, *e.g.* a number of cells at one stage or another undergoing an extra division or failing to participate in a division, would account very simply for considerable variation in the number of constituent cells.

As a strain ages, or if external conditions are unfavourable (*e.g.* in cold weather), not only does the size of the coenobium tend to decrease, but the number of cells per coenobium also decreases, sometimes proportionately more than the size. In such cases the cells (or rather, protoplasts) are usually larger, and the colonies as a consequence appear different, the network being coarser in texture, *i.e.* there is a tendency to return to the type of structure found in the very early (second and possibly third) generations of the strain. This has been observed repeatedly in cultures of the Rietfontein *V. Rousseletii* and in *V. capensis* on the Flats. Thus, in both very young and very old strains, the cells are usually fewer and larger than in strains that are at the height of their development.

#### *Types of Cells composing the Coenobium.*

Two types of cells are found in the coenobium: (1) Vegetative or somatic cells, the "Arbeitszellen" of Klein (1890, p. 47), forming the "working partnership" which Klein regarded as mainly nutritive. These cells have lost the power of further division. (2) Specialised reproductive cells which are differentiated from the somatic cells at an early stage prior to the inversion of the embryo, either at the last cell-division or earlier. These are of three kinds: (*a*) Gonidia (the "Parthenogonidia" of the earlier writers), which give rise by repeated division to the daughter colonies; (*b*) male initial cells, which in the same way give rise to globoids of spermatozooids; and (*c*) female initial cells, which develop into oogonia, each of which contains a single oosphere (Plate XXXIX, E).

The reproductive cells are never found at the anterior pole; the gonidia are confined to the posterior half, the sexual initial cells to the posterior two-thirds or three-quarters of the coenobium.

#### *The Somatic Cell.*

The somatic or vegetative cell consists of a ciliated protoplast enclosed within more or less gelatinous walls bounded by limiting

membranes, neighbouring protoplasts being connected with one another by strands of protoplasm. As the colony grows, the space enclosed within the cell walls continually increases in size, whereas the protoplasts, which at first grow too, soon cease to enlarge. As a consequence the protoplasts in adult colonies are some distance from one another, separated by clear spaces which are not coloured by the stains normally used, and which are traversed by the protoplasmic strands connecting adjacent protoplasts.

Among the somatic cells themselves there is some differentiation intimately connected with light perception. The presence or absence of a pigmented eyespot, its size and position are dependent on the position of the cell in the coenobium, and with this variation in the eyespot go the differences found in the shape of the cell. In the anterior half of the colony the cells show distinct dorsi-ventrality (fig. 1, A, B); the colourless ventral side, *i.e.* that part of the cell which faces towards the anterior pole, is often somewhat flattened and usually contains two small contractile vacuoles, while the eyespot is situated on the green dorsal side, its position relative to the apex of the cell varying slightly according to the position of the latter in the coenobium (Plates XIX, A; XXXVIII, E). In the posterior half of the coenobium the dorsi-ventral aspect is less pronounced, becoming progressively less so in respect to cell-form as the posterior pole is approached. Even in this region, however, it is still possible to trace a definite orientation of the cell in the coenobium by studying the insertion of the cilia (fig. 1, C).

1. *Size of Cell.*—The diameter of the cell from membrane to membrane varies according to its position in the colony and the age of the latter. In a very young colony the cells are small and the protoplasts very close to one another, almost touching (Plate XXXVIII, F); as the colony develops the cells enlarge, the protoplasts becoming further apart, particularly in the anterior region. In still older colonies the enlargement of the cells continues, but the protoplasts begin to get smaller, particularly in the posterior half of the coenobium (Plate XIX, B–E).

The variation in the size of the cell and the protoplast in *V. Rousseletii*, according to the position in the colony, is indicated in the following table of measurements:—

Type of coenobium.	Position.	Protoplast.	Cell.
1. Mature asexual 1335 × 1508 $\mu$	Anterior Pole	6 $\mu$	13–18 $\mu$
	Posterior Pole	5 $\mu$	9–13 $\mu$
2. Mature female 963 × 1050 $\mu$	Anterior Pole	5–7 $\mu$	11–13 $\mu$
	Equatorial	4–5 $\mu$	7–9 $\mu$
	Posterior Pole	4–5 $\mu$	7 $\mu$
3. Young asexual 1120 × 1120 $\mu$	Anterior Pole	6–8 $\mu$	10–12 $\mu$
	Equatorial	4–5 $\mu$	7–9 $\mu$
	Posterior Pole	4 $\mu$	7–9 $\mu$

2. *Cell Membranes*.—The cell membranes can usually be seen in living, unstained material; sometimes, however, they do not show clearly, and careful focussing is always necessary. If a drop of a dilute aqueous solution of methylene blue is run in, the membranes show up very distinctly; in living material, if the solution is sufficiently dilute, the colonies continue moving for some time, and the action of the cilia can be followed. The protoplasts with their connecting strands stain blue, the limiting membranes clear, rather deep purple, the “gelatinous” wall between the protoplast and the limiting membranes very faint purple. This method works equally well in living or preserved material.

The outer cell membranes are united to form a common wall to the whole spheroid; this is somewhat thickened and is mucilaginous on the outside. In large mature colonies it generally forms a continuous curve (Plate XV, B), but sometimes, particularly in smaller colonies, the component curves formed by the slight convexity of each cell wall may be distinguished. In the inner membrane, distant usually about 22  $\mu$  (18 to 24  $\mu$ ) from and concentric with the outer membrane, the corresponding curves are usually more clearly marked; it is slightly thinner than the outer membrane (Plate XV, A).

Within the inner membrane, and occupying by far the greater part of the spheroid, is a hollow filled with a mucilaginous liquid. When stained with Delafield's haematoxylin, gentian violet, safranin, or methylene blue this fluid appears as an irregular network of coloured strands, the meshes remaining unstained (*cf.* Pl. XLI, I). No trace was seen in either living colonies or prepared sections of any regular radial arrangement of strands such as Janet (1912, pp. 35–37, figs. 1 and 2) describes and figures for *V. globator*.



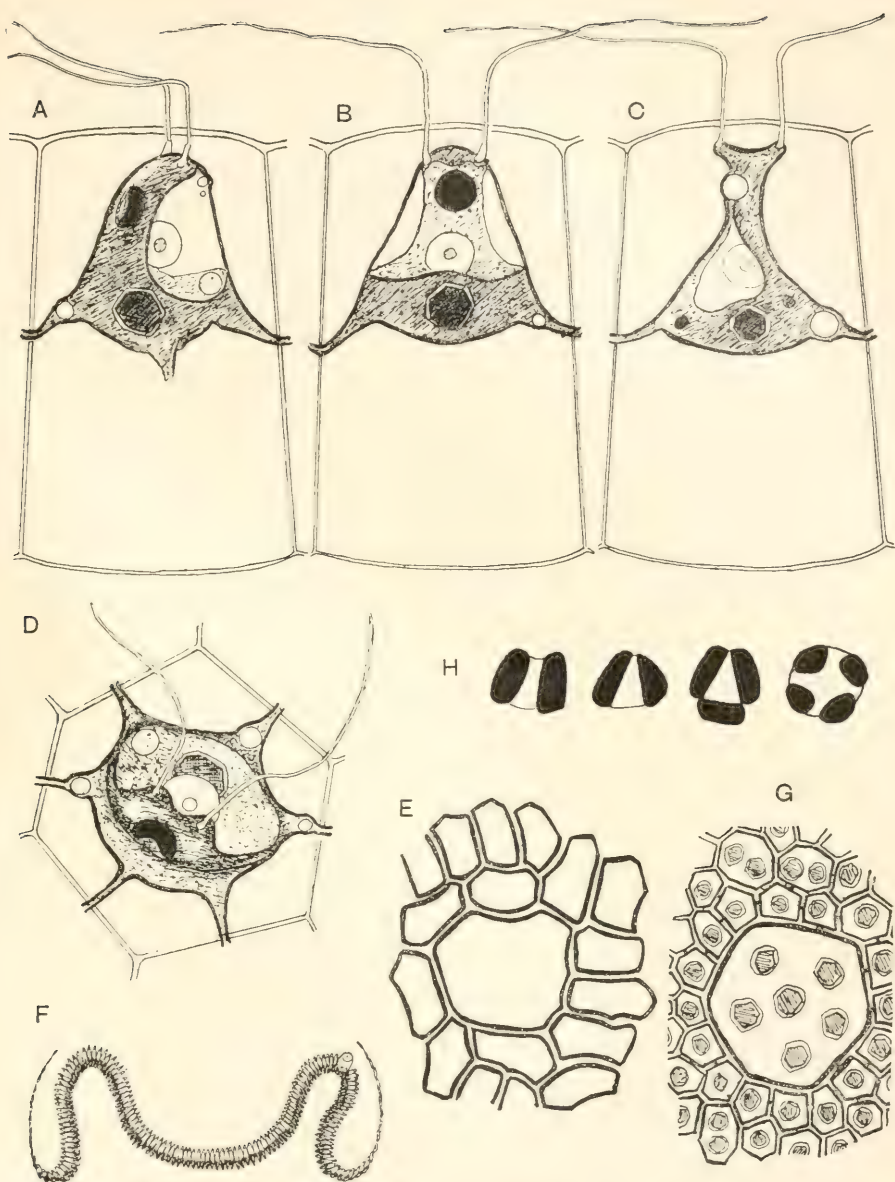


FIG. 1.—*V. Rousseletii* and *V. capensis*. Cell detail.

A, B, Cells from the anterior pole—A, side, and B, front view ; C, cell from posterior pole ; D, cell as seen from above ; E, F, *V. capensis*—E, cells in surface view prior to last division, gonidium already much enlarged ; F, section through inverting colony (infolding complete) showing a gonidium on the right. G, H, *V. Rousseletii*—G, cells from a young male colony in surface view ; one male initial cell much enlarged, three others still small but distinguished by the presence of two pyrenoids ; H, pyrenoids showing varying numbers of starch slabs (stained iodine).

A–D  $\times 3000$  ; E, G  $\times 1500$  ; F  $\times 300$  ; H  $\times 5000$  ; all approximately.



Occasionally in older colonies the central mucilage may become yellowish brown in colour. The inner membrane then shows very clearly even under low powers of magnification (Plate XXXVIII, A). A similar discoloration in senile colonies of *V. globator* was noticed by Klein (1889, p. 157) and ascribed by him to bacteria. In some but not all the colonies showing this discoloration in *V. Rousseletii* bacteria were seen; the discoloration of the mucilage would appear not to be caused entirely by bacterial action.

In surface view, or cut tangentially, the cell prisms are polygonal in outline, most often hexagonal, but occasionally pentagonal or heptagonal. They appear in living unstained material of *V. capensis* in Plate XXXVIII, D; fig. G on the same plate shows the membranes stained with Delafield's haematoxylin. This photo is part of a mature asexual colony, showing the pore above a daughter colony which had been removed by the pressure of the cover-slip. It illustrates the fact that, unless previously carefully fixed, the protoplasmic strands may be withdrawn before the stain takes effect.

3. *Protoplast*.—Not only the size, but also the shape, of the protoplast depends on the age of the cell and its position in the coenobium. Before birth it is oblong in side view, its apex nearly reaching the outer membrane, and polygonal in surface view owing to mutual pressure (Plate XXXIX, A, B). After birth, as the colony matures, the shape of the protoplast changes. Near the anterior pole it remains ovoid or becomes broadly pear-shaped in side view, while elsewhere in the colony it becomes markedly pear-shaped with broad basal portion and more or less attenuated apical outer half (fig. 1, A, B). In mature colonies the cells near the posterior pole are often very characteristic—above the broad basal part the protoplast narrows to form a neck, then at the apex suddenly widens again to form a structure like the head of the hammer-head shark, the cilia being inserted at the two ends of the hammer (fig. 1, C).

After birth, the protoplast of the somatic cell continues to increase in size for some time. After a while, however, about the time that the reproductive cells begin to divide, enlargement ceases, the protoplasts for a time remain the same size, then, as the colony begins to mature, the protoplasts slowly dwindle, particularly in the posterior region.

In surface view in a middle-aged colony the protoplasts appear star-shaped, the rays being formed by the relatively broad protoplasmic connections. The points of the rays reach the centres of the sides of the polygonal membrane, there meeting and fusing with

corresponding rays of the neighbouring cells (fig. 1, D, and Plate XIII, B).

With age, as the central protoplast becomes smaller and the connecting strands grow finer, the star shape tends to disappear, the protoplasts and connecting strands now appearing as a fine network of which the protoplasts form the nodes (Plate XIX, D, E).

*Structure of the Protoplast.*—The protoplast consists of a very thin limiting layer, the ectoplasm, a more or less massive chloroplast, and an inner colourless endoplasm in which the nucleus lies and which is continuous with the ectoplasm in the front of the cell—this colourless “throat” is on that side of the cell which faces towards the anterior pole, or away from the posterior pole, *i.e.* on the ventral side of the cell.

In the endoplasm it is sometimes possible to distinguish a comparatively large vacuole containing one or more highly refractive granules showing Brownian movement; occasionally similar smaller vacuoles may be seen in addition (fig. 1, A, D). These are not to be confused with the contractile vacuoles, from which they are quite distinct. Their content has not been tested, but they are probably similar to the vacuoles described by Dangeard (1924, p. 1041) in the case of *V. globator*.

Each protoplast has a single large pyrenoid, protoplasmic strands connecting it to its neighbours, two long cilia, and a varying number of pulsating vacuoles, while in the anterior part of the colony each contains a large red eyespot or stigma.

*Parts of the Protoplast*—(i) *The Nucleus.*—In the somatic cell the nucleus is small and inconspicuous. In healthy, fairly young coenobia it is sometimes possible, by using a  $\frac{1}{12}$ -inch oil-immersion objective, to make out the nucleus, or rather the nucleolus, in cells of the anterior region. It lies in the colourless hollow portion formed by the cup-shaped chloroplast. Treatment with iodine renders it clearer, staining the nucleolus faintly yellow. In fixed and sectioned material it is clearest when the material has been fixed in a dilute solution of iodine in potassium-iodide, and subsequently hardened in dilute chrome-acetic. In such preparations the nucleolus appears to be composed of several small granules, staining much less deeply than in the reproductive cells. At the best of times, however, in the mature vegetative cell it is inconspicuous, and all nuclear study up to the present has been done on the reproductive cells and the products of their division.

As compared with Janet's figures for *V. globator* (1912, fig. 6), the

nucleus in *V. Rousseletii* and *V. capensis* is apparently a good deal larger.

(ii) *The Chloroplast*.—Each cell contains a single large chloroplast consisting of (1) a massive, saucer-shaped portion filling the broad base of the plastid and extending into the protoplasmic connecting strands, and (2) a broad, strap-shaped portion which extends from the basal part of the cell right up the dorsal side to the apex, sometimes even beyond it and a little way down the ventral side. Usually there is only one such extension, but occasionally one or two smaller processes extend upwards from the base, almost enclosing the central colourless portion; this is, however, rare except in very young cells. In shape, then, the chloroplast may be compared to a thick-bottomed cup with a large piece broken away in the front half. As the cell ages, the chloroplast becomes much less clearly defined and considerably smaller, no longer extending into the protoplasmic connections. When young the whole chloroplast is saturated with chlorophyll of a clear, vivid green colour; with age the colour becomes much lighter.

From the above description and from the figures (fig. 1, A–D) it will be seen that the form of the chloroplast differs considerably from that shown by Janet (1912, p. 45, fig. 6) for *V. globator*, particularly as regards the posterior elongation—here the latter is definitely extended right up into the apex of the cell, where it is in connection with the cilia, whereas in *V. globator* Janet shows the chloroplast as saucer-shaped, the back only slightly higher than the front and not reaching the apex.

(iii) *The Pyrenoid*.—In the development of the gonidium, after the last cell-division prior to inversion, as a general rule each cell contains a single pyrenoid. Occasionally vegetative cells with two pyrenoids are seen, but as a rule when cells with more than one pyrenoid are found they are probably not somatic cells but young reproductive cells (most often male) which have not yet developed beyond the first stage in differentiation (fig. 1, G).

The pyrenoid is embedded more or less centrally in the massive basal portion of the chloroplast. In life the structure shows a dense central portion surrounded by a lighter zone. Starch is formed in rods, platelets, or more irregularly shaped masses on the outside of the central mass. Stained with iodine, these slabs of starch show very clearly, varying from two to five per pyrenoid, four being a common number in mature cells, giving the pyrenoid a cruciform appearance when stained (fig. 1, H).

It is a moot point as to whether the pyrenoids arise always from

division of a pre-existing pyrenoid or *de novo*. Microtomed sections of iodine-fixed material yield some evidence to show that the pyrenoids divide, and examination of young developing daughters in life tends to support this theory of the origin of the pyrenoids from pre-existing ones, but further investigation is necessary to show if this is always the case. Zimmermann (1921, p. 264), like Overton (1889, p. 147), at first regarded the formation of pyrenoids *de novo* as probable, but later (1925, p. 397, note 2), having given more attention to *living* material, saw reason to doubt the validity of his earlier view.

The form of the pyrenoid and the starch secreted by it, as seen here in living or freshly killed material, agree very closely with the observations made by C. Lander (1929, p. 433) in preserved and sectioned material of *V. globator*.

In older vegetative cells as well as in reproductive cells, besides the starch-sheath surrounding the pyrenoid, there are often minute scattered grains of starch. Older cells often contain in addition one or more fairly large, highly refractive globules, probably of volutin, which in unstained material may give to the cell the appearance of possessing more than one pyrenoid (fig. 1, C).

(iv) *Cilia*.—Every *Volvox* cell when young has two cilia; the reproductive cells lose theirs at an early stage of development, but the somatic cells retain theirs throughout their life.

The cilia are long, about treble the length of the protoplast ( $23\ \mu$  approximately), delicate, and colourless; they can, however, usually be fairly easily seen in living colonies even at comparatively low powers of magnification—particularly beautifully in young daughter colonies rotating within the vesicle before birth. The rapidly moving cilia *en masse* appear like a greyish, undulating sheath surrounding the young deep-green colony (*cf.* Plate XLVIII, F).

The cilia are inserted separately at the apex of the cell (fig. 1, A-D), one on each side of the strap-shaped extension of the chloroplast, and are always definitely orientated—the line joining the bases of a pair of cilia is at right angles to the antero-posterior plane of the cell. Thus the members of a pair of cilia are equidistant from the pole of the colony. Consequently, if the cells of a colony have suffered no distortion, and the colony is lying on the side, the two cilia in most of the cells are in the same line of vision and appear to be inserted at the same spot, except near the poles. If, however, the colony is lying with its polar axis at right angles to the slide, optical section gives an equatorial view, the majority of the cells are seen in either



back or front view, and the space between the cilia is very clear (*cf.* Plate XXXIX, A).

At the point of insertion of each cilium is a highly refractive granule, the "Basal Granule" of Zimmermann (1921, p. 285). These are beautifully seen if the microscope is focussed well above the surface of a colony held in place by a supported cover-slip, and then gradually lowered. As the objective is focussed down the lashing upper portions of the cilia first appear and the circular movement can be watched, then the two bright basal granules, the space between them sometimes nearly half the diameter of the protoplast, then the eyespots (if cells in the anterior half are in question), and, finally, the broad base of the cell with its central pyrenoid and connecting strands.

The base of the cilium just above the basal granule is slightly thickened; as the cilium passes through the outer membrane it thins down, the projecting part being apparently of almost uniform thickness, tapering very slightly at the end. The projecting portions of the cilia are differentiated into a more rigid lower third and a flexible outer part, which lashes vigorously, describing a curve in a plane more or less concentric with the surface of the colony and separated from it by the length of the rigid lower portion. The rapid movement of the cilia in the natural state makes the study of their action difficult, but if the coenobium is held in place by the cover-slip, after a time the action begins to slow down and the actual movement of the flexible part can be watched. The action is most easily explained by comparison with a whip which has a short, rigid handle and a long lash, which, after lashing forward, is drawn back with a circular movement. In fixed material the cilia often show a spiral twist at the base of the flexible part.

No rhizoplast connecting the cilia to the nucleus could be seen either in living material or in freshly killed preparations, but signs of such a structure have been traced in some of the microtomed sections, though without sufficient definition to arrive at any conclusion as to its structure or nature. Zimmermann (1921, p. 218) failed to see rhizoplasts in the vegetative cells of *V. globator*, but considered that they were probably present, just as in the reproductive cells.

The cilia become very evident if the colony is killed by running in a drop of iodine solution, and even more so if dilute osmic acid is used as the killing agent. In section the cilia stain well with gentian violet.

(v) *Eyespot or Stigma*.—The eyespot or stigma is a very con-



spicuous constituent of the cells in the anterior part of the coenobium (fig. 1, A, B). Situated in the dorsal strap-shaped prolongation of the chloroplast symmetrically beneath the points of insertion of the cilia (fig. 1, D), the eyespot is easily distinguished under comparatively low powers by its bright orange-red colour and high refraction, and since it remains unaltered both in size and colour as the cell ages, while the chloroplast grows smaller and paler, it is even more conspicuous in old than in young colonies.

Viewed from the front or back of the cell it appears as a circular disc  $1.5-2.2\ \mu$ , most often  $2\ \mu$ , in diameter. More often it is seen in side view. It is a lenticular structure, convex towards the inside of the cell, *i.e.* on its anterior side, concave at the back (fig. 1, A, B, D; Plate XXXVIII, D).

Towards the equator of the colony the eyespots become smaller, usually disappearing completely as pigmented spots in the posterior quadrant. As a rule, however, even in these cells a small, highly refractive granule may be distinguished, which, although it contains no haematochrome, probably represents a vestigial eyespot, since it occupies the position of that organ.

As in the case of the cilia, the position of the eyespot has a definite orientation in relation to the axis of the colony, always occupying a position between the points of insertion of the cilia, but well below them, in the upper part of the chloroplast on the dorsal side of the cell, *i.e.* facing in the direction of the anterior pole (Plate XV, A; Plate XIX, A). Its position in relation to the apex of the cell appears to depend somewhat on the position of the cell in the colony. At the anterior pole it is often rather low down in the cell, rather higher further back in the colony.

The photograph shown in fig. D, Plate XXXVIII, was taken from a colony of *V. capensis*, from one of the Belvedere Road vleis at Claremont (Cape Flats). The living colony was lying on the slide with its anterior pole upwards, so that it was possible to focus down directly on to the pole, which lies practically in the centre of the photo. The objective (1.9 mm. oil immersion) was focussed down on to the plane in which the eyespots lie, just below the insertion of the cilia and thus well above the protoplasmic connections, which consequently do not show at all. The eyespots, as seen from above, show well, as do the walls of the cells. The outline of the protoplast is not very sharp, but sufficiently clear for the position of the eyespot in the cell to show, and the shape of the latter as seen in optical cross-section shows very clearly in some of the cells.

Mast (1923, 1927, etc.) has studied the structure and function of the eyespot in great detail. He finds that it is essentially similar throughout the Volvocales, reaching its highest development in *Volvox*, where the light is received by a hyaline lens situated in the hollow of the cup-shaped red structure, *i.e.* on the *dorsal* side of the cell, and that the yellow and red rays are transmitted through the eyespot into the cell, while the green and blue rays are reflected, the resultant bluish-green ray being distinguishable in certain circumstances (1927, p. 206). The stigma directly controls the action of the cilia.

(vi) *Protoplasmic Connections*.—The protoplasmic connections between adjacent cells probably originate in the incomplete division of the cytoplasm during the division of the gonidium—while the greater part of the cytoplasm rounds off round each daughter nucleus, bridges of cytoplasm remain between neighbouring cells. In the two species here in question these “bridges” persist throughout the life of the coenobium.

In fairly young colonies the protoplasmic connecting strands are comparatively thick and distinct; their appearance depends to some extent on the age of the colony and on external conditions. In colonies before and immediately after birth the connections are difficult to see and are merely very small, thread-like bridges between adjacent cells (*cf.* fig. 1, G). After birth, as the protoplasts separate from one another, they get drawn out, and in a typical young middle-aged colony, *i.e.* one in which the gonidia are still in the stage of division (Pl. XIII, B) or, if sexual, where the oospheres are about ready for fertilisation or the sperm bundles beginning to form, the protoplasmic connections are best seen by examining living individuals under a low power against a black background. Since the chloroplast extends into the protoplasmic connections, the whole network is a vivid green colour, the denser protoplasts forming the nodes of the net, the protoplasmic connections the green sides of the mesh.

Examined under higher powers, the strands are seen to be, in part at least, tapering elongations of the broad basal part of the protoplast, broad at their commencement, where contractile vacuoles often occur, dipping slightly downwards and becoming narrowest where they reach the dividing membrane; there is usually a slight thickening at the junction of the two strands, *i.e.* where they pass through the wall. Whether this is actually a thickening of the strand or, more probably, due to the structure of the wall, was doubtful. Not infrequently a contractile vacuole occurs in the

strand near this junction node, but this is usually in older colonies. As the growth of the coenobium continues, the connections become progressively more attenuated and lose their green colour.

In life, in normal conditions, the protoplasmic connections are usually sufficiently obvious, but in fixed material it is often a very different matter (*cf.* Plate XXXVIII, G). If the fixative used is alcohol, the connections often disappear more or less completely. Formalin is better if the right strength (about 3 per cent.) is used, but even with formalin they are sometimes lost. From this point of view as well as others the best fixative for use in the field is undoubtedly an aqueous solution of iodine in potassium iodide (see Chamberlain, 1924, p. 178), allowed to act for 24 hours or even longer before washing, after which the material is transferred to 10 per cent. glycerine. In material fixed by this method the protoplasmic strands are beautifully clear and the cells undistorted (Plate XVII, B).

Even in living material, however, the protoplasmic strands may sometimes be withdrawn completely, either from a part or the whole of a colony. Colonies have been seen in which the strands had disappeared from the anterior quadrant, where the cells were rounded in outline, while elsewhere in the colony the protoplasmic strands were quite normal. In material brought indoors, particularly in warm weather, the connections sometimes disappear. Probably their absence is always a pathological condition.

Usually the strands connect two cells directly, but not infrequently, particularly in older colonies, the strands show considerable anastomosing. A strand from one protoplast branches, the branches passing to different protoplasts or different points of the same neighbouring protoplast (Plate XIX, E), or neighbouring strands are connected with one another by more delicate cross strands.

A comparative study of the process of inversion of the daughter colonies in the various South African species of *Volvox* throws interesting light on the probable history of the evolution of the protoplasmic connections in *Volvox*. The subject has already been discussed briefly elsewhere (Pocock, p. 486), and the data are still incomplete, since as yet it has not been possible to procure *living* material of the other species in question (*V. gigas*, *V. africanus*, and *V. aureus*). The assumption made there, that the various forms constitute a progressive series culminating in those species which in the adult have well-developed connections between adjacent cells, is based not only on general principles but also largely on the degree of complexity in the development of the daughter colonies,

particularly in their mode of inversion. The subject is an interesting one and would probably repay further study.

(vii) *Contractile Vacuoles*.—In addition to the highly refractive food vacuoles already referred to, each cell possesses a varying number of contracting or pulsating vacuoles. They may occur in the colourless throat (*i.e.* upper ventral portion) of the cell, in the outer layers of the broad basal part usually near the bases of the connecting strands, or actually in the strands themselves (fig. 1, Plate XIX, C-E).

Those in the upper part of the cell are usually difficult to distinguish, particularly in the anterior part of the colony; in the cells near the posterior pole they are often clear, especially in older colonies. Whether they are always present in this region is not clear; more than one in the throat of a somatic cell was rarely seen. In the basal part of the cell, on the other hand, they are very easily seen in surface view, particularly if the oil-immersion lens is used. In number they vary considerably, one cell may show only one vacuole in this region or as many as four or five. They appear to be within the outer layer of the chloroplast, since in diastole a thin layer of green is sometimes distinguishable outside the vacuole. When the vacuoles occur in the connecting strands, usually in old colonies, they show very clearly.

As the colony ages, the number and size of the contractile vacuoles tend to increase. This also depends to some extent on external conditions; for instance, material which has been kept in culture for some time often becomes strongly vacuolate, as noticed by Klein (1890, p. 9) in the European species.

The period of pulsation for any one vacuole remained fairly constant during the time of observation, and varied from 15 to 55 seconds in those which were timed. Most often the period was in the neighbourhood of 30 seconds. No relations could be found between the periods of the various vacuoles of any one cell.

In the reproductive cells the number of vacuoles is fairly high, but there, too, excessive vacuolation would appear to be a pathological sign.

The system of pulsating vacuoles here observed is obviously very similar to that found in *V. globator* and described by Klein (1890, p. 9), Janet (1912, pp. 52-53), etc., the chief differences from their descriptions being the presence apparently of only one, or possibly not even one, vacuole in the throat of the cell, and the position of the vacuole, apparently within the outer layer of the chloroplast, not merely within the ectoplasm.



*Entity and Interdependence of the Volvox Cell.*

The vegetative cells of a *Volvox* colony are interdependent and intimately united with one another by the protoplasmic connecting strands. Yet they retain their individuality—each is in itself a complete individual in so far as its own immediate life-processes are concerned; it absorbs, manufactures food, initiates movement, etc., but it has lost the power of further division or of reproduction. Yet it is possible for it to continue existence if separated from its sister cells, although this separate existence is very short-lived.

If the colony is slightly crushed by pressure on the cover-slip it is sometimes possible to separate the vegetative cells, or rather the protoplasts, more or less completely without injuring them. Such naked protoplasts may continue moving in an aimless way for some time. Relieved from mutual pressure and strain, the protoplast alters in shape, becoming an elongated pear shape with rounded base, all angles disappearing, so that it looks not unlike a form of *Chlamydomonas*. Such separated cells may be seen in Plate XLV, F, mixed with free sperms from which they are distinguished by their larger size, large chloroplast (stained dark by iodine), and rotund shape; one shows a very large eyespot at the apex.

*Change in Appearance of the Vegetative Cells.*

As the colony ages, the appearance of the cell network constantly alters. At first the closely packed cells form a dense green network, which often appears as though built up of a number of green 5- or 6-rayed stars united to one another by the points of the rays (Plate XIII, B).

As the distance between the protoplasts increases, the connecting strands become more and more drawn out, the green colour disappears from them entirely except just at the broad base, the protoplasts themselves become smaller and paler with ill-defined chloroplasts, and the whole network is very fine, with delicate attenuated meshes connecting the small nodes (Plate XIX, D, E). The pyrenoids grow smaller, and highly refractive globules of volutin or other metabolic substances, as well as the contractile vacuoles, become proportionately more conspicuous. Since the eyespots in the anterior cells do not change, in such old colonies they show up very clearly.

Thus it is possible to judge of the age of an individual colony by inspection of the vegetative cells alone, irrespective of the state of the reproductive cells or the size of the colony.



*Comparison of Cell Structure in V. Rousseletii and V. capensis  
with that of V. globator.*

From the foregoing account it will be seen that the structure in the two South African species in question is essentially similar to that of *V. globator* as described by the workers quoted, though differing from these descriptions in some details. It must, however, be emphasised that, whereas in these two species the structure has been studied in the *living* cell, *V. globator* has only been seen by the writer preserved or in section, so that for comparison of cell structure it has been necessary to depend entirely on the published accounts. To study the form of the chloroplast in particular, living material is essential—"the best stain for protoplasm is chlorophyll"—it is possible that if *V. globator* were studied side by side with these two South African species the apparent differences in cell structure would disappear, particularly as regards the shape of the chloroplast and the distribution of the contractile vacuoles.

In spite of the very marked likeness to the known structure of *V. globator*, the cell constituents have been described here as fully as possible, since only thus can we hope to arrive at a clear conception of the group as a whole and of the inter-relationships between the species. Lack of such detailed descriptions from *living* material is responsible for a great deal, if not all, of the confusion in our knowledge of the whole genus or group of genera. In this connection the remarks of Pascher in his account of the genus *Volvox* may be again recalled (1927, p. 450).

It may be as well to emphasise here the very great advantage gained by using the  $\frac{1}{12}$ -inch oil-immersion objective for examination of the living cell; details in structure, as, for example, the dorsal extension of the chloroplast, can be seen clearly examined thus which can hardly be distinguished with the usual high-power objective.

*Reproduction.*

*Differentiation of Reproductive Cells.*—As already stated, at an early stage of the development of the daughter colonies reproductive cells are distinguishable from the somatic cells by their greater size and two or more pyrenoids. The stage at which this is first seen varies, but in both species it is long before birth (Plate XXXIX, B).

In the cultures of *V. Rousseletii* from Rietfontein, at birth these cells, if asexual gonidia, are about twice the diameter of the vegetative cells, with a large well-marked nucleus. As regards the sexual cells,

while some are already well developed, others, particularly the male cells, remain small till much later. It could not be determined whether in this species the reproductive cells are differentiated before inversion or immediately subsequent thereto. In a few cases inverting daughters showed cells rather larger than the majority, but in most cases no difference between the component cells could be detected before inversion (*cf.* Plate XLI, G, H). Very soon after completion of inversion, however, they become conspicuous.

In *V. capensis*, from the Cape Flats, on the other hand, abundant evidence was forthcoming to show that the reproductive cells are differentiated before inversion and before the last cell division (fig. 1, E, F; Plate XLI, A). The inference seems inevitable that here, at any rate, the reproductive cells are cytologically equivalent to at least two vegetative cells, possibly more; this is also suggested by the larger number of protoplasmic connections between the gonidia and the neighbouring somatic cells.

In both species no division of the reproductive cells takes place until some considerable time subsequent to birth; during the intervening period the only visible changes which take place in them are further increase in size and in the number of pyrenoids and, later, loss of the cilia. The sexual reproductive initials are smaller than the asexual at birth, and show great variation in size in one colony, particularly in the case of the male.

*Types of Reproductive Cells and their Distribution.*—The three types of reproductive cells are at first similar to one another in structure and appearance, but are distinguished by their subsequent behaviour:

1. *The Gonidium*, by repeated division, gives rise to a daughter colony similar to the parent.

2. *The Male Initial Cell, Antheridium Mother-cell, or Androgonidium* by a similar method gives rise to the sperm globoid.

3. *The Female Initial Cell, Oogonium Mother-cell, or Gynogonidium* produces a single large oosphere.

The terms Androgonidium and Gynogonidium were introduced by early workers and have been very generally used subsequently. They are convenient terms by which to describe the large cells which eventually give rise to the male and female gametes, but since their use is controversial they are avoided here. The homologies of the various reproductive cells are discussed later.

In *V. Rousseletii* the three types of reproductive cells are in general found in separate colonies, while in *V. capensis* male and female cells are formed in the same colony, the former always in much smaller

numbers than the latter. An area of varying extent about the anterior pole is always free of reproductive cells of any kind.

### *Number and Arrangement of Reproductive Cells.*

#### *A. The Gonidium.*

The gonidia are usually confined to the posterior half of the colony. In both species the number of gonidia which develop is most commonly 8, arranged alternately in two planes, one plane approximately equatorial, the other half-way between equator and posterior pole. There appears to be no rule governing the order of development, nor is there any variation in size attributable to position in the colony (Plate XIII, D, and Plate XX, A). The number is, however, by no means constant; it may vary in *V. Rousseletii* from extreme cases of 1 up to 16 (*cf.* Plate XVIII, A to D) or in *V. capensis* to 20, the highest number as yet seen in one colony of this species (Plate XIV, A).

Sometimes a number of gonidia which have not divided, or have divided once or twice and then ceased development, can be seen in a colony; particularly if fewer than 8 have developed, the full number is usually made up by such abortive gonidia (Plate XX, A).

In *V. capensis* it is not unusual to find cells which are like the majority of the somatic cells, but are very slightly larger and richer in food reserves, often without visible protoplasmic connections. It is possible that these represent incipient gonidia as postulated by Klein in *V. globator* (1890, p. 18). They are, however, very different in appearance from the undoubted abortive gonidia which in colonies with few daughters are nearly always to be found in the positions which daughters should normally occupy. More probably these aberrant cells are somatic cells which have in some way been cut off from their neighbours by the withdrawal of the connecting strands and in which metabolic substances have accumulated.

When more than eight daughters develop they tend to lie more or less in the same two planes as the eight primary ones (Plate XVIII, A), but are not confined to these planes. They are rather more regularly disposed in *V. Rousseletii* than in *V. capensis*.

West's (1910, p. 102) description of the daughter colonies in *V. Rousseletii* as "regularly eight" is misleading and founded on observation of a single collecting of material obviously at an early stage of an asexual phase. In his account (1918, p. 1) of the second lot of material from Ussangu West makes no further remark on the asexual colonies, and his figures show only sexual colonies.

If, as has been done in the case of both *V. Rousseletii* from Rietfontein and of *V. capensis* from the Cape Flats, a single *Volvox* strain be kept constantly under observation throughout a development period, the number is found to vary greatly, according partly to the age of the strain, partly to external conditions. The following observations illustrate this point:

1. *V. Rousseletii*.—Mr. Steer's original culture from Rietfontein soil.

22nd February 1930 (a fortnight after the culture was started).—*Volvox* abundant, entirely asexual. Daughter colonies most often 8, but often more, up to 13 (Plate XVIII, A). Size of mature individual very large. Largest seen  $2058 \times 2037 \mu$ , with 9 daughters; many over  $1500 \mu$ .

8th March.—Many young sexual colonies present, males specially abundant. Daughter colonies 4 to 8.

23rd March.—Mainly sexual. Asexual with 2 to 6 daughters (Plate XVIII, C).

28th March.—Sexual colonies very few. Asexual with 1 to 3, rarely 4, daughters. Size much smaller (Plate XVIII, D).

The colonies had become much smaller in size, with far fewer daughters. It continued thus reproducing vegetatively for some time, then entirely disappeared, only to reappear in the same culture some weeks later.

A similar sequence of events was observed later in the case of an offshoot of this culture which had established itself in Mr. Steer's fishpond, though here the number of daughter colonies per coenobium never rose so high. Towards the end of the period of activity the average number of daughter colonies dropped to 3–4.

2. *V. capensis*, on the Cape Flats.

*V. capensis* appears to be particularly sensitive to temperature changes. On the Flats it appears in the winter months, since then only do pools form in this area. Early in the season the maximum number of daughter colonies is 8, often fewer, but if there is a spell of warm sunny days the number rises considerably. In 1931 some vleis persisted unusually late in the season, right into November, in which month there was a spell of very hot weather. During this the activity increased enormously, as many as 20 daughters having been counted in one colony, while 13, 16, 17, and 19 daughters were common. The temperature of the water at noon was frequently over  $90^{\circ}$  F. just below the surface, some  $6^{\circ}$  cooler at a depth of 8 or 9



inches. Finally a temperature of 96° F. at noon was recorded, and the rampant growth of the *Volvox* was cut short—the following day hardly any *Volvox* remained although water still stood in the pools to a depth of 4 inches, and on the previous day both sexual and asexual colonies were abundant. Two days later not a trace of *Volvox* could be found. Whether this disappearance was due entirely to too high a temperature, or to a sudden altering of the surrounding medium by a shower of rain that fell on the succeeding day, or to some quite different cause, is a problem still awaiting solution. Certainly during this hot spell in general appearance and behaviour this Cape Flats *Volvox* became very similar to the form of the species collected in Northern Rhodesia (Rich and Pocock, p. 449).

A similar sudden cessation apparently at the height of its development has recently been observed in *V. Rousseletii* at Kimberley. In this case, too, it occurred when the level of the water in the pool fell to 4 or 5 inches.

*B. The Male Initial Cell, Antheridium Mother-cell, or Androgonidium.*

1. *V. Rousseletii*.—The male initial cells are found in purely male colonies; very rarely isolated ones develop in the female colonies, the sperm bundles formed from them being often slightly abnormal. Such globoids were not seen in the Rietfontein material, but in exceptionally rich sexual material from Kimberley they are not uncommon here and there in otherwise purely female colonies.

Such occurrences are, however, exceptional, and the rule is for this species to be dioecious.

The male initial cells are scattered thickly over from two-thirds to three-quarters of the surface of the coenobium, leaving free only a comparatively small area at the anterior pole (Plate XX, B, D). Owing to the varying rate of development it is difficult to obtain accurate counts, since some have matured and the sperm bundles have escaped, while others are still only at the first stage of enlargement. In the Rietfontein cultures, however, repeated camera-lucida counts of isolated male colonies gave 150 to 200 as the average number, but this should probably be rather higher. In the Kimberley material, however, this number was enormously exceeded—one very large male colony gave a count of over 800 androgonidia in all stages, from young ones still enlarging to mature sperm globoids—which amply justifies West's (1918, p. 2) description of "androgonidia very numerous, usually several hundred."



2. *V. capensis*.—In *V. capensis*, however, as in *V. globator*, the sexual colonies are monoecious and strongly protandrous. If mature sexual colonies are under examination they appear purely female, containing only oospores (Plate XIII, E). But small, fairly regular gaps in the cell network are invariably present, indicating the positions where sperm globoids have matured and escaped. Only very rarely are sperm globoids seen in a colony with well-developed oospheres. Usually they are seen in young colonies only, where the oospheres are still in the stage of enlargement (Plate XIII, C) and not nearly ready for fertilisation.

As in the case of the daughter colonies, the male globoids seem often to average 8, arranged similarly in two planes, but in addition to these 8 primary male cells there are often considerably more in the colony. The total number varies greatly and it is difficult to fix the minimum, since here, too, some may have escaped before some of the others, even of the primary 8, have developed. Colonies with 2 or 3 sperm globoids only have been seen, but gaps in the cell network showed that more had been formed. The following observations give some indication of the variation in numbers:—

(1) Of 19 colonies examined at various times from Ottery Road, 10 had 8 male globoids, 4 had 10, 2 had 9, 2 had 5 but in one of these a gap was seen, 1 had 4 but showed 3 gaps.

(2) In the Belvedere Road Vlei III towards the end of the 1931 season the number of sperm bundles was high; 8 was still a common number, but colonies with 12, 13, and as many as 19 were found.

(3) In the material from N. Rhodesia the number of globoids is usually high, much higher than has ever been observed at the Cape, as many as 35 having been counted in a single colony.

When more than 8 globoids are formed, the arrangement in two planes becomes obscured, the extra androgonidia being scattered about among the young oospheres, although usually the positions of the original 8 can be traced.

As in the case of the asexual daughters, there is some evidence to indicate that the number of sperm globoids is influenced by external conditions, particularly temperature.

#### C. *The Female Initial Cell, Oogonium Mother-cell, or Gynogonidium.*

1. *V. Rousseletii*.—The female initial cells occur in the posterior two-thirds to three-quarters of the female colony and are generally numerous, the majority coming to maturity as spiny-coated oospores.

In the Rietfontein cultures numerous counts gave from 102 to 230 per colony, with an average of 180, but occasionally counts as low as 60 to 70 were made, while in the Kimberley material the numbers were very much greater—in one large colony over 400 were counted.

2. *V. capensis*.—On the Cape Flats the average is about 120, but as in *V. Rousseletii* the limits of variation are wide, from 60 to 160. Occasionally a strain has been found which has a very low average of oospores, *i.e.* 60 to 70, but usually the number is over 100.

As with the other reproductive cells, external conditions as well as inherent characteristics are operative, higher temperatures apparently causing the production of large numbers of oospores.

### *Development of the Reproductive Cells.*

#### *A. Gonidium.*

1. In both *V. Rousseletii* and *V. capensis* the gonidium is at first distinguished from the vegetative cells by its larger size, somewhat darker colour, two or more pyrenoids, and large nucleus and nucleolus. Like the vegetative cells it has two long cilia and several contractile vacuoles. In surface view it is more or less star-shaped, and is surrounded by a ring of some 9 to 12 vegetative cells with which it is connected by a number of stout protoplasmic strands (fig. 2, A, B, Plate XXXVIII, G). After the birth of the colony the gonidium continues to enlarge, and during this second phase of enlargement the cilia are lost, the gonidium sinks inwards, and the shape alters considerably. In side view it is very broad in proportion to its polar diameter, with a massive basal chloroplast and large conspicuous nucleus; in surface view it appears round instead of star-shaped, and the connecting strands are becoming drawn out (fig. 2, C).

Since this enlargement takes place within the peripheral layer of vegetative cells, the latter are not much displaced thereby, except that as the gonidium sinks from its original place in the outer layer it draws down with it the circle of cells with which it is in direct protoplasmic connection (Plate XXXVIII, E). Thus the developing daughter lies beneath a marked depression in the parent, this depression or pore being floored with the outer wall of the original gonidial cell. Eventually this becomes the pore of liberation for the mature daughter. The space occupied by this pore is not much larger than that occupied by the gonidium in its later phase of enlargement. The fact that the number of cells round the gonidium is about double that round any one somatic cell is another argument for regarding

the gonidium as really equivalent to two if not more somatic cells (Plate XXXVIII, G).

The cell membrane of the gonidium has meanwhile enlarged considerably, forming a large delicate vesicle projecting far into the interior of the parent, and thus well protected while at the same time maintaining its contact with the surrounding water through the outer wall of the gonidial cell. This vesicle continues to enlarge as the daughter develops, and always encloses it. Even when the daughter is mature and already moving, the vesicle is intact and is sufficiently large for the young daughter to turn and twist in any direction. Similar vesicles are formed in the case of the sexual cells (Plate XLI, I).

In the mature gonidium, as in the sexual reproductive cells, the structure of the resting nucleus can, to a certain extent, be made out, even in the living cell. Treated with iodine it becomes clearer. The nucleolus is a dense, rounded body, more or less central in the clear, colourless cytoplasm, which stains very faintly yellow with iodine, the nucleolus staining brownish yellow. The delicate nuclear membrane is sometimes partly visible, but usually the whole or a part is hidden by the dense, bowl-shaped chloroplast. The nucleus usually shows best in surface view (*cf.* Plate XLII, D, male initial cell in surface view).

2. *Period of Cell Division*.—Some time subsequent to birth, while the colony is still young, the gonidium begins to divide. The first division is longitudinal, *i.e.* radial in relation to the parent, and divides the gonidium into two halves placed symmetrically in relation to the pore above (fig. 2, D). The second division is also in a plane parallel to a radius of the parent, but at right angles to the first plane of division. Hence, in surface view the daughter now appears as composed of four equal cells arranged in a cross. From the beginning of cell-division the formation of a hollow spheroid is foreshadowed—the apices of the two cells formed by the first division are inclined inward; in the second division this is more marked, while the broadening of the basal portions causes the apices, containing the conspicuous nuclei, to separate slightly (fig. 2, E).

In the third division the planes of division are oblique to the preceding, so that the 8-celled stage is bowl-shaped (fig. 2, F). In other words, the physiological polar axes of the component cells are constantly becoming more and more inclined to one another, the apical pole always being directed inwards (Zimmermann, 1923, p. 290). Very soon the plane of division in each cell is radial to the spheroid,

and continues to be so throughout the succeeding divisions. The bowl at first has a wide opening, the phialopore, but as division proceeds the bowl becomes more and more a rounded hollow, and the opening grows progressively smaller, until on completion of cell-division only a very small pore is left (fig. 2, G-L). In the earlier stages of division all the resultant cells are connected protoplasmically with the parent, but from the 16-celled stage onward only the cells round the phialopore are so connected (fig. 2, G, H). At first, as these cells divide, the outermost of the two retains the connecting strands, but after a time, as the cells grow progressively smaller, this ceases to be the case, and several series of cells are cut off within the ring of connecting strands (fig. 2, I, J). Finally, when the divisions are completed the resultant spheroid is attached to the parent by a ring of protoplasmic connecting strands attached round the small phialopore, but at some distance from its edge, which thus forms a free lip to the pore within the ring of protoplasmic strands (fig. 2, K).

The sequence of divisions and the arrangement of the resultant cells have been worked out very fully in the case of *V. aureus* to the tenth division by Janet (1923 pp. 97 *et seq.*).

Such a detailed study of the division is beyond the scope of the present investigation, but, so far as could be ascertained, division proceeds on essentially the same lines in *V. Rousseletii* and *V. capensis*, although, as already indicated, probably with less regularity in synchronisation of the divisions of the whole mass of cells. The number of successive divisions varies considerably in individual cases, but is, of course, always very much greater than in *V. aureus*. At any given time, in addition to the large mature colonies, there are always present smaller mature colonies composed of fewer cells. On the whole, however, the number of successive divisions in a strong strain at its optimum development cannot be less than fourteen ( $2^{14}=16,384$ ) nor more than sixteen ( $2^{16}=65,536$ ), while in very old or very young strains, or in adverse conditions, particularly cold weather, the number drops to thirteen or possibly even lower.

During the early stages of division the cells of the colony are about as wide as they are long, or even wider, presenting a large area to the surface of the colony, the large chloroplast being spread out near this surface, filling the whole base of the cell. Although the ratio between the axes alters as division proceeds, the surface area always remains large in proportion to the size of the cell, the plane of division being perpendicular to the surface. The chloroplast is deep green, with



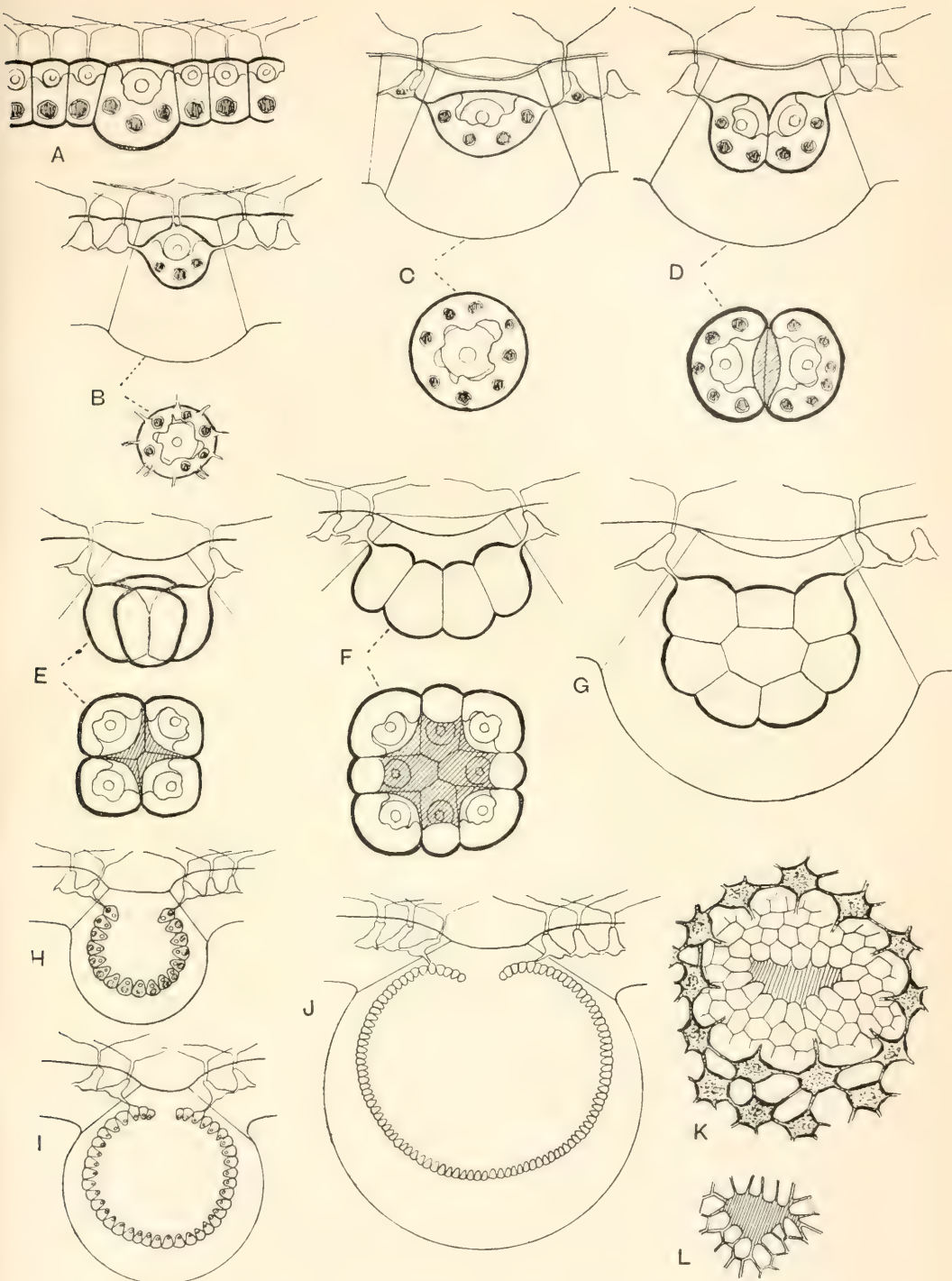


FIG. 2.—*V. Rousseletii* and *V. capensis*. Development of the gonidium.

A, Gonidium and somatic cells from recently inverted colony ; B, C, side and surface views of enlarging gonidia before and after loss of cilia ; D–F, the same of 2, 4, and 8-celled stages ; G, 16-celled stage ; H–J, sections of developing embryos to show formation of free lip of phialopore ; K, L, phialopore on completion of cell-division ; in K, surrounding cells of the parent colony shaded.

A  $\times 2000$ ; B–G  $\times 1000$ ; H–J  $\times 300$ ; K, L  $\times 1250$ ; all approximately.



several pyrenoids—all characters indicating great metabolic activity in the dividing cells themselves, and although the daughter is always in protoplasmic connection with the parent it is improbable that much nutritive material is derived from the parent; some, no doubt, passes in through the connecting strands, since the cells immediately surrounding the pore above the developing daughter are usually nearly devoid of starch, but it seems certain that the bulk of the necessary food, which must be considerable, is manufactured by the daughter itself. It must be remembered that the vesicle surrounding the colony is in direct contact with the surrounding water just as is each cell of the parent colony; thus the water can easily enter the vesicle and flow over the surface of the daughter colony, which also receives an ample supply of light. Further, the content of the vesicle shows no trace of the mucilaginous substance which fills the hollow of the parent colony (Plate XLI, I), although some mucilage may be formed inside the developing daughter even before inversion. The protoplasmic strands get drawn out as development proceeds (*cf.* Plate XXXVIII, G), and latterly at any rate they probably serve mainly for the support and anchorage of the developing daughter, at the same time helping to keep the phialopore open.

As development proceeds, the colony increases considerably in bulk, but increase in size is not proportional to the rate of cell-division; hence in each division the cells are smaller than in the preceding one. When division is complete, the daughter colony is a hollow oblate spheroid, somewhat flattened on the outer side, with the shorter diameter perpendicular to the surface of the parent; the cells composing it are somewhat irregular in surface view, and rather broad in proportion to their length. In *V. capensis* at this stage the gonidia are already clearly differentiated and show well in microtomed sections as well as in living material (fig. 1, E); they are very distinct in sections of inverting daughter colonies (fig. 1, F). In *V. Rousseletii*, on the other hand, it is usually very difficult, if not impossible, to distinguish the gonidia until after completion of inversion: apparently, if they are already differentiated, as seems probable, they are very much smaller than in *V. capensis* and only enlarge subsequent to inversion. Each cell has an extensive chloroplast occupying the outer superficial region of the cell and containing a single large pyrenoid, except in the case of reproductive cells which contain at least two pyrenoids. The phialopore or ostiole is a small opening in the flattened side lying immediately below the parent "pore" or shallow depression in the periphery of the parent. It is somewhat irregular in outline

(fig. 2, K, L; Plate XL, A), and may be either quadrilateral or triangular in shape, in *V. capensis* more often the latter. The two shapes may occur side by side in young daughters of the same parent.

Microtomed sections of the developing daughter show the cells as broadly wedge-shaped, the broad chloroplast-containing base directed outwards, the roundly pointed colourless apex towards which the nucleus lies directed inwards.

When the development and structure of the gonidium is compared with the accounts given in the cases of *V. aureus* and *V. globator* by Janet and others the following points emerge :—

(1) The shape of the gonidium prior to the first division differs from that in *V. aureus*, where it is described as almost spherical (Janet, 1923, p. 109).

(2) The number of successive divisions is in general greater than in *V. globator* and much greater than in *V. aureus*.

(3) The phialopore or ostiole always lies symmetrically beneath the area of attachment to the parent, and the protoplasmic strands connecting daughter to parent are attached in a ring round the phialopore, but in later stages of division *not to the cells immediately abutting on the pore*. Several rows of cells form a free rim to the pore within the connecting strands (fig. 2, J, K).

(4) The connections between mother and daughter remain intact till a much later stage in development.

In *V. globator*, wherever the attachment of daughter colony to parent is shown, the protoplasmic strands are always depicted as attached to the cells immediately round the pore (*cf.* Janet (1912, p. 35, fig. 1), Zimmermann (1925, p. 399, fig. 1)). Possibly it is a detail of structure which has escaped notice in that species; the preserved material of *V. globator* available for comparison is not sufficiently well preserved to show the mode of attachment of the embryo.

3. *Period of re-orientation—Inversion.*—How long an interval, if any, elapses between the completion of the last cell-division in the daughter colony and the initiation of the changes that lead to the eventual re-orientation of the cells composing it has not yet been determined. It is probably short.

The process of inversion is essentially similar in *V. Rousseletti* and *V. capensis*; variations were noticed, and it was thought that there might be specific differences, but further observations showed that these are not constant specifically but are differences in behaviour of individual daughters.

The process falls into two well-marked stages, the second only

of which has as yet been described for any species. The first, the Preparatory Stage, lasts for some time, probably at least 2 to 4 hours; the second, the actual process of Inversion, when once it has commenced, is more rapid, being completed in from 30 minutes to an hour, the average time taken being about 40 minutes.

A. *Preparatory Stage*.—(1) At the end of cell-division the ostiole or phialopore is very small, sometimes almost obliterated, with rather ill-defined outline (Plate XL, A). The first sign of change preparatory to inversion is seen in the lip; the outline becomes more definite (Plate XL, B; Plate XLI, A), the cells forming the lip more regular in outline and darker in colour, while the ratio between the axes of the cells alters, the radial axis elongating at the expense of the equatorial. Meanwhile the free edge of the lip curls gradually inward and downward into the hollow of the daughter, the position of the connecting strands often showing very clearly at this stage (fig. 3, A, and Plate XL, C).

(2) Almost coincident with this change in the lip of the pore, the daughter colony, which at the end of cell-division presented a firm rounded outline flattened on the outer side, begins to dent irregularly. Dents appear first at one point then at another, becoming progressively deeper and more extensive as the lip curls further inward. During this denting period the young colony has a distinctly battered appearance and is in a state of highly unstable equilibrium (fig. 3, A-C; Plate XL, C, D). In preserved material, unless special care has been taken in fixing, colonies at this stage nearly always appear completely collapsed.

(3) After some time the dents begin to disappear, the lip to straighten out, and the colony has once more a firm, rounded outline (fig. 3, D; Plate XL, E, F). Now, however, the size of the colony is slightly smaller; the radial diameter is no longer the shorter, it is either equal to or a little longer than the equatorial. The cells are longer and narrower and more regularly polygonal, as seen in surface view. Both the movement of the lip and the denting of the young colony are caused at least in part by this change in the shape of the cells, which continues during the next stage of the process. The change does not take place simultaneously in all the cells of the colony, but first in one part, then in another; hence the irregular appearance and disappearance of the dents. What rôle exactly the free lip plays in the process is not clear. It is evidently important, and apparently the change in shape of the cells is initiated there, and yet later in the process it is these cells which are most distorted and pulled out tangentially.

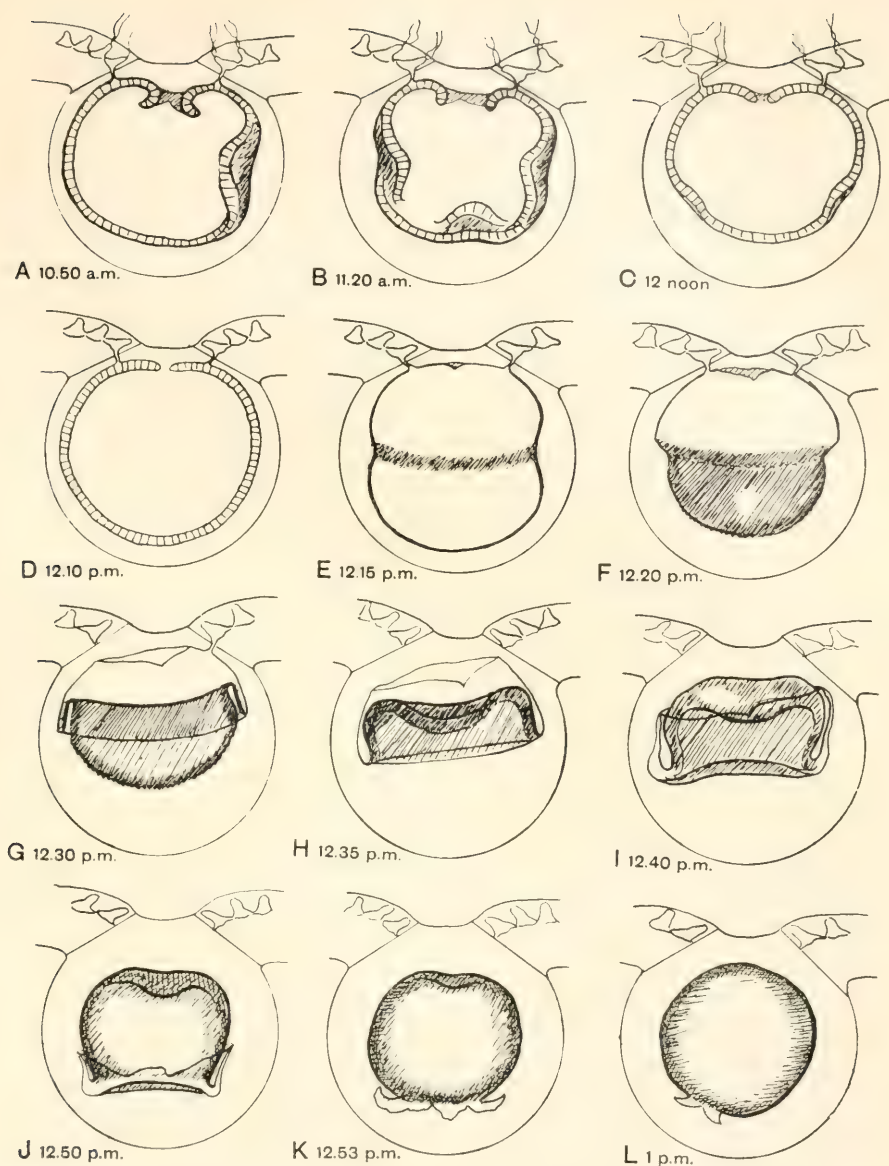


FIG. 3.—*V. Rousseletii* and *V. capensis*. Inversion of the daughter colony.

A–D, preparation; E–L, inversion.

A, Lip of phialopore depressed, denting beginning; B, denting more extensive; C, dents smoothing out, lips straightening; D, lip straight, colony rounded out again; E, equatorial constriction forming ("Hour-glass" stage); F, contraction spread over posterior half; G, infolding of posterior half beginning; H, infolding complete; I, posterior half beginning to emerge through much enlarged phialopore ("Hat" stage); J, "Flask" stage beginning; K, "Flask" stage ending; L, inversion complete, lobes of phialopore closing.

All  $\times 200$  approximately.



The straightening of the lip, almost closing the ostiole, marks the end of the preparatory stage, and is usually slightly subsequent to the final ironing out of the dents and is completed some two hours or more after the first signs of change are seen (fig. 3, D; Plate XL, F). In Plate XL, B, a colony of *V. capensis* with 8 daughters all in the preparatory denting stage is shown—evidently the dents were already beginning to disappear, and during the time that elapsed between the taking of this photograph and the one shown on Plate XLI, A, of the central upper daughter (lower, as the photograph is mounted), this daughter at any rate had smoothed out, although the phialopore lip is still depressed. The camera was focussed on to the lip, which is obviously at the same level as the region near the outside of the colony, *i.e.* just above the equator. These colonies already showed well-developed reproductive cells, probably gonidia, some of which are just discernible in the photograph. The parent had split under its own weight in the first photograph, but in the latter it was, of course, under a cover-slip.

B. *Inversion*.—(4) “Hour-glass” Stage. Without perceptible break the further changes which produce the actual turning inside out of the colony follow. These changes first become apparent in the equatorial region of the young colony; a slight constriction appears in this region, or it may be shifted slightly towards either pole (fig. 3, E; Plate XL, G). Externally this constriction appears slightly darker than the rest of the colony, which has now a shape rather like an hour-glass. In optical section the cells in the region of the constriction are seen to be narrower and more elongated, the inner apex clear, the outer part dense, dark green, and rounded. Microtomed sections reveal the fact that at this stage the cilia begin to form, not subsequent to inversion, as Zimmermann (1925, p. 401) and Janet (1923, p. 129) describe in *V. globator*; the inner apex of the cell becomes long drawn-out and pointed in the process, and it appears probable that cilia formation and the subsequent activity of the rudimentary cilia play an important part in the process of inversion. In living material the cilia were not observed until a later stage, and possibly they are too small to be seen except in microtomed sections.

(5) Starting from the equatorial constriction these changes gradually spread over the whole posterior portion, which consequently now appears much darker and considerably smaller than the anterior half (fig. 3, F; Plate XL, H). The posterior cells are narrow, elongated, and pointed at both ends, the pointed outer ends often being



continued as mucilage-strands. Cells in this stage bear an extraordinary resemblance to sperms, not only in shape but also in the lateral flattening of the cell constituents, pyrenoid and nucleus in particular (fig. 4, B).

(6) The posterior half begins to fold into the anterior half, the infolding starting at the original constriction (fig. 3, G) and gradually extending towards the posterior pole until the whole of the posterior hemisphere is folded into the anterior (fig. 3, H; Plate XL, I, J). At this stage the posterior cells are in a state of compression; during the following stages, on the other hand, they begin to expand again, while the anterior cells (eventually to become posterior in the mature colony) are in a state of tension, particularly those near the pore.

(7) As the infolding approaches completion, the pore enlarges greatly (fig. 3, E-H; Plate XL, H-J), continuing to stretch until it is as wide as the colony. Up to now the daughter has been kept in position by the ring of protoplasmic strands connecting it to the parent. These strands have stretched until finally as the enlargement of the pore continues they break and the daughter is entirely free in the vesicle; very occasionally a few strands may remain attached somewhat longer. As a consequence at this stage the daughter is very apt to turn over and present a polar instead of a lateral view to the observer (*cf.* Plate XL, K), making it very difficult to obtain a good complete series of photographs of one and the same inverting daughter; hence the earlier stages are illustrated by photographs of one daughter (Plate XL, C-J), the later stages more clearly by those of another which is more favourably placed (Plate XLI, B-F).

As the pore enlarges the cells round it are pulled apart; the protoplasmic connections between the cells, very difficult to distinguish hitherto, get stretched and are very plainly seen, while the cells are contorted into strange shapes (fig. 4, A). It seems probable that Klein (1890, fig. 24) was observing cells in this state when he drew his figure of "abnormal cells from the anterior half of an asexual colony of *V. aureus*." This stage is well illustrated in the photograph of the large colony shown in Plate XLI, G.

(8) "Bowler-hat" Stage.—The posterior half, with the pole still dented inwards, begins to emerge through the much stretched pore (Plate XLI, B); at this stage ciliary action was first observed in living material. The short, developing cilia may sometimes be seen lashing vigorously while still within the anterior half.

As the dense, dark green posterior half emerges, the paler, stretched anterior half slips down forming the brim of a hat-shaped structure

of which the posterior part forms the crown (fig. 3, I; Plate XLI, C-D).

(9) "Flask" Stage.—As more and more of the colony emerges the structure assumes the shape of an inverted flask with dented base and turned back flange (the lip of the phialopore) round the narrowing neck (fig. 3, J; Plate XLI, E, F). The changes in shape of the cells and cilia formation have gradually spread into the anterior half, at this stage the flange alone remaining in the stretched condition. This flange or fringe is sometimes distinctly three-, more rarely four-lobed, more often it is very irregular in appearance.

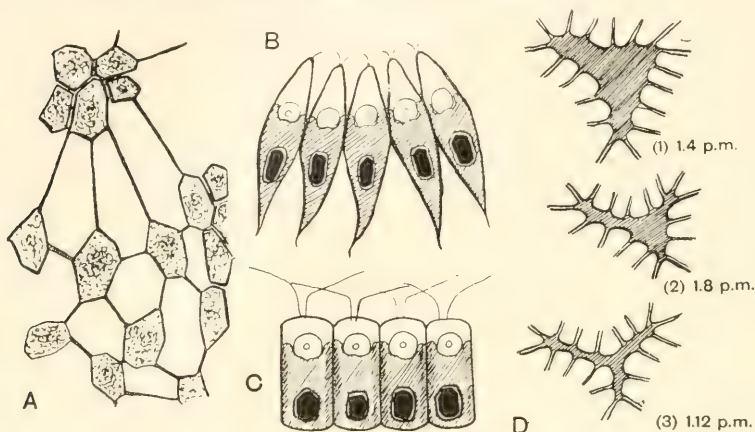


FIG. 4.—Inversion of daughter colonies. Cell detail.

A, Cells and protoplasmic connections from anterior half about stage G; B, cells from posterior pole, stage F, G; C, cells from recently inverted colony; D, closing phialopore of colony shown in fig. 3.

A-C  $\times$  about 2500; D  $\times$  about 1250.

(10) The cells of the fringe contract, become more closely packed, the lobes fold inward to fill up the contracting pore. The dent at the opposite anterior pole of the inverted colony gradually straightens out (fig. 3, K, L; Plate XLI, F).

(11) The daughter colony begins to move slowly, at first with a slight rocking movement, probably due to incomplete co-ordination of the ciliary movement. Soon, however, this rights itself and a slow but steady rotary movement sets in.

(12) Meanwhile the pore, which may sometimes still be seen even after movement has commenced, has continued to close and finally becomes completely obliterated (fig. 4, D). In healthy colonies no trace whatsoever of the pore can be seen. Zimmermann (1925,

p. 401) states that it remains recognisable as a clear "cell-free" spot, apparently in *V. globator* as well as in *V. aureus*, but he is not quite clear on this point. In these African species certainly no such spot can be traced.

The cilia are still very short on completion of inversion, and continue to elongate for some time.

### *Results of Inversion.*

Inversion is now complete, the inner pole of the developing daughter has become the anterior pole, while the phialoporic pole is now the posterior pole of the rotating daughter. Further, the orientation of each cell has been inverted, the polar axis has been turned through an angle of  $180^\circ$  so that the pole innermost in cell-division is now outwards, while the chloroplast-containing end is on the inner side of the young colony. The elongation of the polar axis of the young colony is sometimes apparent immediately after inversion, sometimes does not appear till later. Occasionally the daughters remain practically spherical till after birth.

After inversion the daughter is actually slightly smaller in size than on completion of cell-division, since the long axis of each cell is now the radial one. The cells are closely packed together and have entirely lost their sperm-like appearance; in an optical section of a young inverted colony the cells appear oblong in form, both outer and inner ends broad and slightly rounded (fig. 2, A, and fig. 4, C; Plate XXXIX, A). The outer end is colourless, containing the fairly large nucleus and bearing the two cilia, while the inner two-thirds is filled by the deep-green chloroplast with the pyrenoid.

The above details have been obtained primarily by continuous observation of living material. Daughters have been watched during periods of several hours, from the very first sign of preparation for inversion that could be detected until inversion was complete, and it is only such continuous observation that allows the sequence of events to be followed. This has been supplemented by examination of sections of material specially fixed with a view to obtaining good inversion figures (hence killed with dilute osmic acid or iodine solution). Such preparations confirmed the observations already made in living material of the change in shape of the cells, showing the very sharp pointing of the ends (fig. 4, B, and Plate XLI, H). Further, in iodine-fixed material the rudimentary cilia can be seen at a very early stage. Apparently the elongating and pointing of the cells is directly

connected with cilia formation. As each part escapes through the widening pore the pointing of the cells disappears again, and the cells assume the palisade-like form described above, and already beginning to be apparent in the section of the "Flask" stage (Plate XLI, I).

At this stage there is no common envelope. The limiting membranes or cell walls are laid down subsequent to inversion. Traces of secretion of mucilage into the hollow of the inverted daughter appear early; in sections appropriately stained the dilute mucilaginous content of the daughter colonies, though much less deeply stained than that of the parent, is clearly contrasted with the clear, unstained cavity of the vesicle surrounding the colony.

Kuschakewitsch (1931, p. 330) suggested that the secretion of intercellular jelly which "according to Overton" (1889) intervened between completion of cell-division and appearance of the cilia, might be in causal connection with the process of inversion (*cf.* also, Janet, 1923, p. 129). Again, Zimmermann (1925, p. 400) states that the process of "Exkuvation" is manifestly caused by the swelling of the intercellular substance between the apical cell ends. These explanations seem very inadequate. The fact that the emission of the cilia coincides with the beginning of the actual process of inversion and is not subsequent to inversion, however, offers a much more probable explanation of the mechanism of inversion, while the changes that take place in the shape of the cells in the earlier stages might account for many of the phenomena observed. It is possible that the formation of mucilaginous substance between the cells assists in the process. The existence of protoplasmic continuity between the cells enables the whole mass to act as a single entity (see Pocock, *loc. cit.*, p. 486).

#### *Time of Inversion.*

Both *V. Rousseletii* and *V. capensis* were examined at all hours of the day and most of the hours of the night, except between 5 and 8 a.m. Inverting daughters were observed at all hours of both day and night. At first it was thought that inversion took place only during the day, and that by bringing coenobia that had daughters in the stage succeeding completion of division from the dark into the bright light of the microscope illuminant, these were stimulated to invert. But material which had been standing in the dark was examined at 8.45 p.m. and showed daughters already half inverted, hence in this case, at any rate, inversion had started in the dark.



Fuller observations are necessary before reaching a final conclusion on this point, not only on the time of inversion itself, but also as regards the time at which nuclear division takes place. There is probably a close relation between the two, since inversion follows closely on completion of division. Shaw speaks of “. . . night . . . a time when so many of the changes in the life-history of *Volvox* occur.” Karsten (1918), working with various algae, found that, in general, nuclear division is initiated by change in light intensity, *e.g.* from light to dark, and concludes that by day the cells assimilate  $\text{CO}_2$ , and at night use up the food stored during the day in cell-division.

In *Volvox* as yet it has not been possible to determine whether cell-division is confined to certain periods of the 24 hours. So far as external observations go, the results obtained do not support Shaw's remark so far as concerns the African species. In *V. aureus* Zimmermann (1921, p. 270) certainly found nuclear division proceeding during the day, as he describes various stages of cell-division from material fixed at 3 p.m.

The results of observations as to the time at which inversion takes place though inconclusive are perhaps worth recording. Although inversion was at various times observed at all hours of the day, there seem to be certain optimum times which, however, depend to some extent on external conditions. Material examined between 8 and 10 a.m. usually showed many daughters in the preparatory stages. From 10 a.m. to about noon many inverting daughters were seen; thence onwards the number usually decreased markedly, increasing again somewhat towards the late afternoon or early evening, after which it again falls. Inverting daughters were more numerous in warm weather, but this was to be expected since a rise in temperature evidently speeds up development in general.

*Fixation.*—To obtain good inversion figures the best method was found to be killing with dilute osmic acid, then washing in several changes of water, and fixing in dilute chrome-acetic, as used in Flemming's Fluid No. 2, overnight. Good results were also obtained by using Powers' iodine method.

### *The Discovery of Inversion.*

It is hardly credible that in so well known an organism as *Volvox*, which has been investigated again and again during the last two centuries, a phenomenon so striking as that of inversion of the daughter colonies should have been completely overlooked. Yet such is



apparently the case. No mention of it can be found in the extensive *Volvox* literature until Powers (1908, p. 158) recorded its occurrence in his description of species of *Volvox* from Nebraska, and photographed some of the stages. It struck him as most interesting, and he sought for it successfully in most of the other species with which he worked. Unfortunately, he was unable to watch the complete process in living material, and as a consequence misinterpreted the sequence of events. For example, his figure of the "kettle" stage shows an early, not a late stage of the process. Further, in the absence of knowledge of the cytology of *Volvox*, he failed to recognise the full interest and importance of the phenomenon. As a result, Powers' discovery, although it is referred to by both West (1916, p. 179) and Shaw (1922, p. 109), failed to obtain the recognition it undoubtedly deserved. His photographs are, nevertheless, excellent so far as they go, and enable one to determine which type of inversion exists in the species he figures.

In 1921 Zimmermann (1923, pp. 584-585) worked at the cytology of *Volvox* (chiefly *V. aureus*), and as a result realised that the orientation of the cell constituents during cell-division, as compared with that in the mature daughter colony, involved a complete inversion of every cell. At the time he thought that this turning of the cell axis through an angle of  $180^\circ$  took place in each individual cell, as did Merton (1908, p. 470) in the case of *Pleodorina illinoensis*. The following year there was published a short paper by Kuschakewitsch (1922, p. 131) describing observations actually made by him three years previously, in the summer of 1919, which threw a flood of light on the whole problem. From this it became apparent that no shifting of the cell constituents takes place within the cell, but that when cell-division is complete the whole hollow spheroid formed turns inside out, thus reversing the orientation of the individual cells.\*

Zimmermann (1923, p. 584) published a very interesting critique on this paper by Kuschakewitsch and subsequently investigated the process in both *V. aureus* and *V. globator*, in the case of the latter giving a series of photographs of successive stages of inversion. His account of the process in *V. aureus* differs in certain points from

\* Unfortunately, this paper has not been procurable for reference; both Janet (1923, p. 127) and Zimmermann (1923, pp. 584-585) refer fairly fully to Kuschakewitsch's work, and their accounts were at first followed for the details given here. Quite recently, however, Kuschakewitsch's paper has been republished in the Archiv für Protistenkunde (Bd. 73, 1931, p. 324) and has therefore become more accessible.

that of Kuschakewitsch for *V. tertius* and *V. aureus*, as will be most clearly seen by a comparison of his figures (1925, p. 399, *g-k*) with those given by Janet (1923, Plate 18, fig. 104). Although the process in these two species does not concern us directly here, it is interesting when we come to consider inversion in the case of the sperm globoids and germ colonies. Pascher's account (*loc. cit.*, p. 457) is based on Zimmermann's work. The subject has already been discussed elsewhere (Pocock, p. 485) in connection with *V. gigas* and *V. africanus*.

Inversion has been described in *Eudorina* and *Gonium* by Hartmann (1921, p. 223). Subsequent observers have noted it not only in all the regular colony forming members of the *Volvocales* but also in other members, *e.g.* *Haematococcus*. Thus the phenomenon of cell-division to form a hollow sphere followed by inversion is characteristic of the *Volvocales* as a whole, showing progressive advance in complexity throughout the group as the number of constituent cells in the colony increases, and culminating in the species of *Volvox* of the *Eu-Volvox* section, of which *V. Rousseletii* and *V. capensis* are members. The known facts are ably summarised by Pascher (1927, p. 457) in so far as concerns the asexually formed daughters. Logically, one is led to expect the same sequence of events wherever in any member of the group a single cell divides to form a spherical mass of cells, *i.e.* in *Volvox* in the development of the sperm bundles and in the colony formed from the oospore. The present investigation shows this expectation to be justified in both cases.

Powers describes the process as the "invagination and final inversion" of the young colonies (1908, p. 141); Kuschakewitsch (1931, p. 328) makes a similar use of the term invagination in describing the first half of the process, and later in his discussion (p. 331) on the significance of his discovery he considers the development of the daughter colony from the gonidium to be a sort of internal budding comparable to the invagination of a part of the wall of the parent colony. The term has, unhappily, been used to describe the whole process of re-orientation by subsequent workers in America, either misunderstanding the use of the term made by these writers or misled by a superficial resemblance at an early stage of the process to the invagination of the blastula in animal embryology, *e.g.* that of *Amphioxus* (Dendy, 1914, p. 47, fig. 13). But, whereas there the essential part of the process is the infolding of one hemisphere against the other to form a double wall, the cells of the two layers of the wall being inversely orientated, in *Volvox*, although

the beginning of inversion resembles the infolding of the blastula, the resemblance is but a temporary one, and the final result entirely different.

The use of the term invagination in this connection, then, is to be avoided. Kuschakewitsch describes the process as one of "pseudo-gastrulation," but that, too, is apt to give rise to misconception. Janet makes use of the term "Extroversion," and Zimmermann uses "Inkurvation" for the first half, "Exkurvation" for the second half of the process. But as the existing English word "Inversion" has already been used and, while non-committal, describes the process sufficiently accurately, it seems unnecessary to coin a new word.

#### *Development of Daughter Colony after Inversion.*

After inversion is completed the daughter colony, still enclosed in its vesicle, remains within the parent rotating on its axis, which itself is constantly altering its position. If the reproductive cells have not become apparent before inversion, they are very soon clearly distinguishable in the embryo colony (Plate XXXIX, B). The daughter increases in size, both somatic and reproductive cells becoming larger, and the cilia lengthening proportionately.

Shaw (1922a, p. 491), who had certainly never seen living material of *V. Rousseletii*, thought that in this species the gonidia were not differentiated in size until some considerable time after birth, but he is mistaken in this; they are quite distinct very soon after inversion, long before the colony escapes, though they do not divide until later.

Zimmermann (1925, p. 401) states that in *V. globator* the size increases rapidly by separation of the cells due to continuous swelling of the intercellular substance, "so that sooner or later the daughter colony squeezes itself into the interior of the mother colony." However that may be in the European species, it is certainly not the case in healthy colonies of either *V. Rousseletii* or *V. capensis*, unless very exceptionally. However large or numerous the daughter colonies may be, each remains enclosed in the vesicle formed from the gonidium wall, which enlarges with the developing colony and remains intact right up to the birth of the latter. It is large enough to allow ample room for the daughter to move freely within it.

*Birth of the Young Colony.*

From a very early stage in the development of the gonidium, as has already been described, the area where the outer gonidium wall is in contact with the surrounding medium forms the floor of a shallow pit, or depression, in the surface of the mother colony, for convenience spoken of as the parent pore (fig. 3; Plate XXXVIII, E, G), and this continues to be the case after inversion.

When the daughter is ready to escape, however, the pit disappears, and instead of being depressed this area of the parent surface begins to protrude. The daughter shows a kind of boring movement, apparently pressing on the parent wall, and the cells round the pore begin to separate. It appears as if the daughter secretes a ferment, which digests the substance forming the walls between the plastids without attacking the latter or their connecting strands. It might perhaps be possible to test the truth of this theory by micro-chemical methods, but as yet no attempt has been made to do so. Whatever the cause, whether simply increased pressure by the daughter or ferment action, the area of and round the parental pore disintegrates, and the daughter squeezes its way out, leaving behind it a large, irregularly circular gap in the parent (Plate XXXIX, C, D). In the figure the partially separated cells show on each side of the outer pole of the escaping daughter, while the second figure shows the daughter free in the water, and in addition two other colonies showing gaps left by escaping daughters. The edges of the gap sometimes fall back into position, but from the mode of its formation it is obvious that, once formed, it can never completely close again. Each daughter makes its own pore of escape in the same way.

The exceptions to this rule are so rare that it may be regarded as constant. As an instance the following may be quoted—the only case of its kind yet observed: On 16th October 1930 a large colony of *V. capensis*, measuring  $1258 \times 1344 \mu$  on the slide and containing 8 large mature daughters, was under observation. The smallest daughter measured  $286 \times 315 \mu$ , the largest  $329 \times 358 \mu$ , hence all were very near in size. The notes made at the time are: "Daughters all moving, some escaping, boring their way outwards; the cells of the parent separating, some of the protoplasts swimming away. Two, however, did not escape out, but *inwards*, and swam about inside the parent (the first case observed) for a short time, then escaped. Gonidia large and distinct, but undivided." But this colony was not freshly collected—it was brought in from the ditch



that runs along near the Wetton Road vlei on 12th October, and thus, when these observations were made, had been kept in culture, although in vlei water, for four days. Further, even if this had not affected it, when a colony of such a size, especially when so loaded with daughters, is placed on the slide a great part of its weight is no longer supported by water, and it is very liable to split merely under its own weight. Hence, though interesting, it is an exception on which much reliance cannot be placed, since conditions were certainly far from natural.

The parent colony may continue active for some time after the escape of the daughters, even though it has several large gaps in its posterior half. Eventually, however, it disintegrates.

As the daughters escape their rate of rotation and progression becomes very high, and they swim about exceedingly rapidly. At first they are very deep green owing to the close juxtaposition of the component cells, but as development proceeds the protoplasts become further and further apart owing to the gelatinisation of the intervening walls, the protoplasmic connections become more apparent, the eyespots in the anterior half become well developed, and soon the gonidia begin to divide.

In vigorous strains young escaped daughters of all ages are seen moving about among the mature colonies. The daughter colonies are large at birth, on the whole larger in *V. Rousseletii* than in *V. capensis*, but the actual size varies enormously; this depends partly on the age of the strain, partly on external conditions, but also to a great extent on individual idiosyncrasy of the gonidium, cf. Plate XIV, A, where all 14 daughters in the large colony are mature, but show very great variation in size.

In *V. Rousseletii* one of the smallest daughters seen free measured  $182 \times 204 \mu$ , while the largest seen *in situ* was  $630 \times 672 \mu$ . This was, however, exceptional, although daughters over  $500 \mu$  in diameter (e.g.  $525 \times 567 \mu$ ) are not uncommon at times. The average in vigorous normal strains lies between  $300 \mu$  and  $400 \mu$ , falling considerably as the strain ages.

In *V. capensis* the largest daughter colony measured *in situ* was  $467 \times 482 \mu$ ; colonies averaging  $320 \times 360 \mu$  are common, but here again the size decreases with the age of the strain. In cold weather, too, the daughters are noticeably smaller and composed of fewer cells.

In general, the size of the daughter at birth is directly proportional to the size at the beginning of inversion, and this, too, varies greatly. Daughters were measured at the beginning of the preparatory stage,



*i.e.* when denting was first appearing. Of these the largest measured  $274 \times 257 \mu$  (nearly always before inversion the polar diameter is the shorter). Another measured  $164 \times 164 \mu$  before inversion,  $125 \times 133 \mu$  immediately after inversion. Yet another,  $125 \times 121 \mu$  in the denting stage, measured  $116 \times 125 \mu$  on completion of inversion.

#### B. Male Initial Cell, or Antheridium Mother-cell.

In the case of the development of the male initial cell, *V. Rousseletii* is a far more favourable object for investigation than *V. globator* or even than *V. capensis*. The very large number of sperm bundles found in one colony, and the fact that they develop at very diverse rates, makes it possible to find every stage of development, from young, still ciliated mother-cells to escaping sperm globoids, in one and the same colony. Further, the course of development is extraordinarily constant—it is very rare indeed in a healthy vigorous strain to find sperm globoids that vary in either structure or number of sperms. When such do occur it is almost invariably in material which shows other signs of abnormality; for example, material which has been subjected to unfavourable conditions, has been kept for some time in culture, or is nearing the end of its period of sexual activity.

In both *V. Rousseletii* and *V. capensis* the mature sperm globoids are similar in appearance and structure, but there are several interesting divergences in the course of their development. In both, the life of the antheridium mother-cell and the sperm globoid which develops within it can be divided into distinct periods, viz.:—(1) period of enlargement, (2) period of cell-division, (3) period of re-orientation, including preparation for inversion and inversion proper, (4) maturation of sperm globoid within the parent, (5) escape from the parent, (6) life subsequent to escape culminating in (7) escape of the sperms from the globoid.

Much of the life-history is common to both species. The development and structure will be described in detail in the case of *V. Rousseletii*, partly because it was in this form that it was first studied, and partly because it is undoubtedly the most favourable for observation. Then the points in which *V. capensis* differs from it will be considered.

It was endeavoured to obtain as full a photographic record as possible of the successive stages. It was of course impossible to do this for one individual androgonidium, but photos have been taken showing most of the early stages in development (not the later

stages of cell-division) in different androgonidia, and the course of inversion in single individuals. The difficulties in obtaining good photographs are considerable. After the first few cell-divisions we are dealing with a dense, very small individual (diameter about  $30\ \mu$  when mature) suspended inside the parent. When young the latter, too, is comparatively dense, hence the best results were obtained from large, fairly mature colonies where many of the globoids had already escaped, and the cells of the parent were wide apart and consequently not very dense; even late in life such colonies often still contain young developing antheridium mother-cells, and thus offer favourable subjects for observation.

In the case of the earlier stages a fortunate chance helped considerably. A young male colony with antheridia in all stages happened to get split by pressure of the cover-slip, one half lying with the hollow inside facing upwards. Along the free edge of this several antheridium mother-cells and antheridia in the very early stages of development, each with its vesicle intact, were exposed, and presented specially good subjects for photographing (*cf.* Plate XLII, D-J), since they were not masked by over-lying cells. The best results were obtained from living material, using the 1.9 mm. oil-immersion objective and a Leitz-3 ocular. The stronger oculars were less satisfactory, cutting off too much light, with some loss of definition. It was found preferable to obtain the additional magnification by using a greater extension of the camera attachment.

In obtaining the series showing inversion, it proved exceedingly difficult to obtain a good, complete series. To begin with, the preparatory stage is prolonged, and it was extremely difficult to be sure when a bundle was just beginning to invert. Then it involved keeping the chosen bundle under observation with the oil-immersion lens for several hours without any crushing or drying. In several cases a good series was begun, only to be spoilt in the middle. Series which proved excellent at some stages were spoilt by slight movement of the object at crucial moments. In a series where the end was good, the beginning was often unsatisfactory, and *vice versa*. The one chosen to illustrate this paper (Plate XLIII) is in some ways not the best obtained; nor is it complete, since after the twelfth negative had been exposed, the projection lamp came to the end of its life, and work was held up for some days before another could be procured. As a consequence the last three photographs showing the completion of the process were underexposed, and these stages have had to be supplied from another series. But the early stages on the

whole show well in the series chosen, and the next three photographs (Plate XLIV, A-C), though of another globoid, serve sufficiently well to complete the pictorial record of inversion, while the third series (Plate XLIV, D-F) illustrates rather nicely individual variation in form, and shows the "Hat" stage viewed from a different angle.

*V. Rousseletii*.—1. *Period of Enlargement and Shifting of Polar Axis.*

The young male initial cell is similar in form and structure to the gonidium—more or less broadly pear-shaped, with clear anterior end bearing two cilia and containing a large nucleus with well-defined nucleolus (Plate XLII, A, B, D), there is a massive cup-shaped chloroplast with several pyrenoids and a varying number of contractile vacuoles. Owing to their large number and presence still undivided in quite large mature colonies, it is much easier to observe the early stages than in the case of the gonidium. Unlike the gonidium, the male initial cell does not broaden out before division commences. At first it stands in rank with the neighbouring somatic cells (Plate XLII, A, and fig. 5, A), its apex on a level with theirs, distinguished from them only by its greater size and dense cell contents; even at this stage the inner wall begins to protrude into the hollow of the parent, thus commencing the enlarging process whereby the surrounding vesicle is formed. As the cell enlarges the pyrenoids multiply, and the cell begins to drop inward away from the upper surface, the vesicle enlarging inwards correspondingly (fig. 5, B). The cilia disappear (Plate XLII, C, E), the apex occasionally getting somewhat drawn out, and for a time the bases of the cilia may be traced between the cell apex and the outer membrane (fig. 5, C). The fully grown cell has a diameter of about 15 to 20  $\mu$  (*cf.* Overton, 1889, p. 213, in the case of *V. globator*, "Gerade vor der Theilung besitzen die Antheridium-Elternzellen meist einen Durchmesser von 15  $\mu$ ").

Up to now the polar axis of the mother-cell has been radial to the parent colony, hence at right angles to its surface, but at this stage there usually takes place a re-orientation of the cell constituents without any disturbance of the outer cytoplasmic layer, the ectoplasm, which remains as it is, connected with the neighbouring cells by the protoplasmic connecting strands. The whole chloroplast, with all the cell constituents enclosed in it, swings round until the anterior pole, the clear end of the cell containing the nucleus, points sideways or inwards (fig. 5, D to F; Plate XLII, F). Thus the physiological

axis of the cell turns through an angle of from  $90^{\circ}$  to  $135^{\circ}$ , sometimes even more. As a consequence, since the anterior pole of the cell will eventually become the phialoporic pole of the developing body, it follows that the phialopore of the young male bundle instead of lying immediately below the parent pore, as in the case of the young daughter colony formed from the gonidium, is turned sideways or inwards. In the photographs this is well seen in succeeding stages (Plate XLII, G to L). Very occasionally developing males are found with their phialopore directed outwards, but in this species this is exceptional.

A similar shifting of the polar axis of the cell has been described by Zimmermann (1923*b*, p. 289) in a number of algae.

## 2. *Period of Cell-division.*

Cell-division does not begin till after the birth of the parent colony, and then only in some of the male initial-cells, others remaining dormant until later. The shifting of the polar axis within the protoplast is soon followed by cell-division. The first division is always longitudinal,—that is, the physiological polar axis lies in the plane of division which is either perpendicular or inclined at an angle to the radius passing through the mother-cell (fig. 5, G; Plate XLII, G, H, I). In Plate XLII, I, the separating of the anterior ends of the two cells is already evident; the nuclei, or rather the nucleoli, of the cells are visible, that in the right-hand cell particularly clear. In Plate XLII, fig. H, the nucleolus of the nearer cell, the protoplasmic connections, and the vesicle are particularly clear.

The second division is also longitudinal, in a plane at right angles to the first (fig. 5, H; Plate XLII, J). The hollowing to form a cup is more marked, though in the 4- and sometimes even in the 8-celled stage the curvature is sometimes very slight (Plate XLII, K). The 8-celled colony here shown, however, is somewhat unusually flat. In succeeding divisions the polar axes of the individual cells become constantly more inclined inwards, just as in the case of the asexual daughter colony. Up to the 4-celled stage the size of the cells does not differ markedly from that in the corresponding stage of division of the gonidium, but from thence onwards a distinct difference begins. There is some enlargement of the whole mass during division—the undivided mother-cell may reach  $20\ \mu$  in diameter, the hollow spheroid at the end of division measures just over  $40\ \mu$  in longest diameter (*e.g.* that shown on Plate XLII, N, was  $33 \times 41\ \mu$ ), but a great part of this



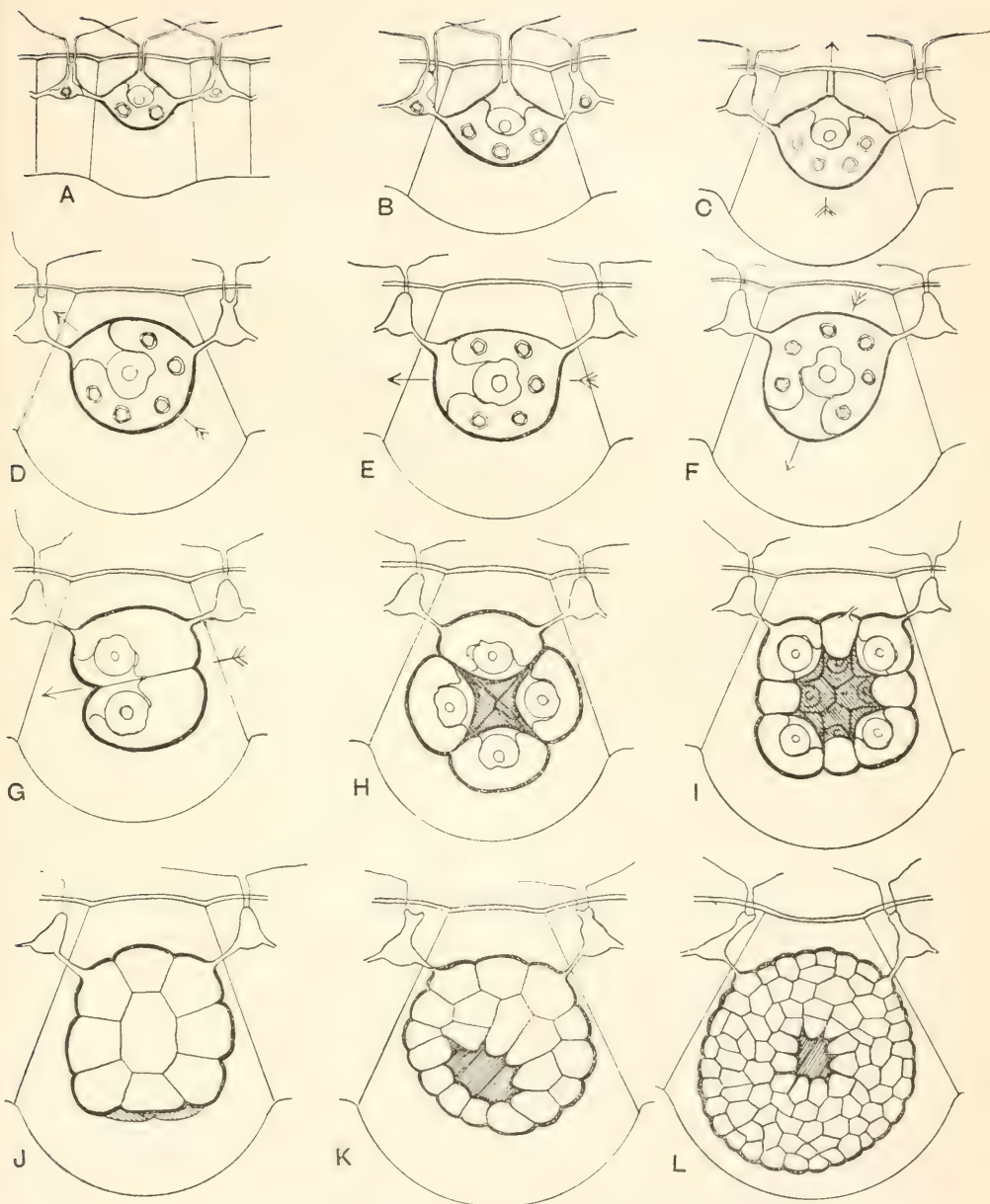


FIG. 5.—*V. Rousseletii*. Development of male initial cell.

A-C, Period of enlargement; D-F, shifting of the physiological axis of the cell; G-K, 2-, 4-, 8-, 16-, and 32-celled stages, the latter "bowl"-shaped, with phialopore directed obliquely downwards; L, cell-division complete, phialopore lateral.

All  $\times$  about 1000.



is occupied by the hollow centre; hence, the enlargement is far less than in the case of the asexual daughter colony and the resultant cells at any stage consequently far smaller.

The total number of divisions is nearly always nine, resulting in a hollow oblate spheroid, more or less kidney-shaped, as seen in side view, nearly circular in polar view, composed of some 512 cells. Very occasionally only eight divisions take place, giving half-size male bundles.

From the 16- to the 64-celled stage the structure appears as a wide-mouthed bowl (fig. 5, J, K; Plate XLII, L, M), the mouth of which gradually grows smaller in succeeding divisions. As a result of the shifting of the polar axis the protoplasmic strands connecting the developing male bundle to the parent are not attached round the phialopore, as in the case of the asexual daughter, but to one side of the colony, round the outer end, thus leaving the lip of the phialopore entirely free. The connecting strands show well in figs. H, K, L on Plate XLI.

At completion of division the globoid lies inside its vesicle within the hollow of the parent, its long axis more or less radial to the parent (Plate XLII, N); the cells are similar in form to those of the daughter colony, but smaller. Each contains a single pyrenoid in a deep green chloroplast lying adpressed to the outer surface of the cell, the inner clear end containing the nucleus. The phialopore is small and rounded in outline (fig. 5, L). Mucilage strands extending across the central hollow between the cells can often be seen even in living material, and more clearly in stained microtomed sections.

### *3. Period of Re-orientation of the Sperm Bundle.*

(a) *Preparation*.—Owing to the small size it is more difficult to watch the changes in cell form than in the case of the daughter colony. Here, as there, the first signs of preparation for inversion are most clearly seen at the phialopore. The lip becomes depressed, curling inwards into the hollow of the spheroid, until it may almost reach the centre (fig. 6, A; Plate XLIII, A, B; Plate XLIV, D), hence it is accompanied by a widening of the pore, as seen in surface view. The denting so characteristic of this stage in the daughter colony is not seen; evidently "denting" is correlated with the much greater size of the daughter. But the change in the shape of the cells soon becomes very apparent—the outer wall is rounded, the long axis is now radial, and the clear inner apex more pointed and well defined.

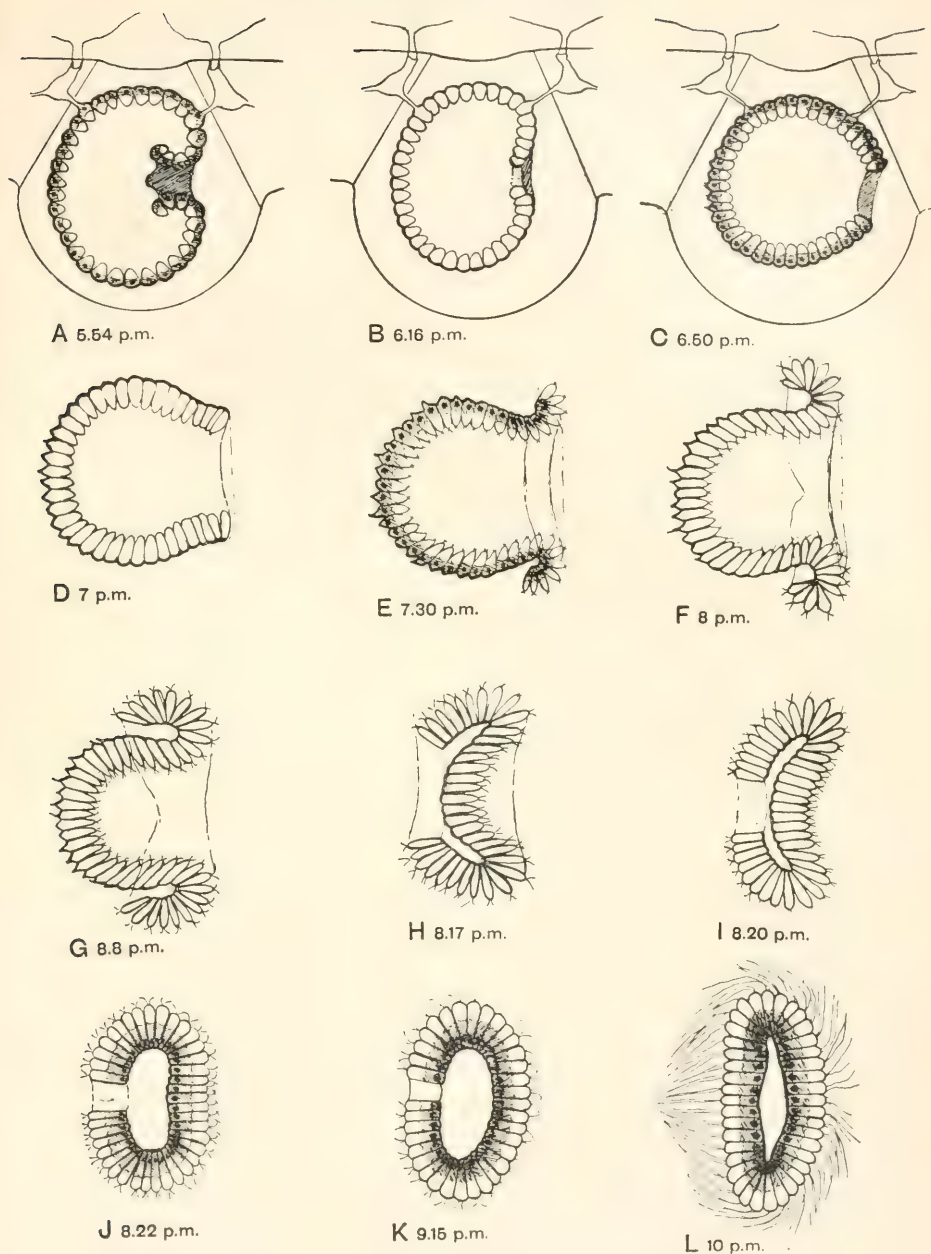


FIG. 6.—*V. Rousseletii*. Inversion of sperm globoid.

A, B, Preparation; C-K, inversion; L, fully formed, recently inverted globoid.  
All  $\times 750$  approximately.

This part of the preparatory stage lasts a considerable time. Eventually the lip of the phialopore begins to rise, and straightens out, more or less completely closing the phialopore (fig. 6, B ; Plate XLIII, C). At this stage it is often almost impossible to distinguish the position of the phialopore, the young colony appearing broadly elliptical or round in optical section, with an uninterrupted wall. The change in shape of the cells is accomplished or immediately followed by the commencement of cilia formation.

(b) *Inversion*.—There is no perceptible pause separating the two phases—perhaps the moment when the lip begins to straighten out should really be regarded as the end of preparation and the beginning of inversion proper. After the lip has straightened out completely the pore begins to widen, and continues widening until it almost reaches the diameter of the whole bundle (fig. 5, C, D ; Plate XLIII, D to F)—the “Thimble” stage.

Meanwhile the change in the shape of the component cells continues, the cells having become very much elongated, the outer ends sharply pointed, especially in the posterior part, often long drawn out, the clear inner ends also sharply pointed (fig. 6, E). At this stage the incipient cilia were first detected—in favourable material the very short cilia may be seen moving in the hollow, while in sections they show distinctly.

As the pore reaches its maximum extension the edges begin to bend outwards and gradually fold back, making a very pretty series of hat-shaped figures—first a *clôche* hat, then a bowler, then wider brimmed hats (fig. 6, F to H ; Plates XLIII, G to K, and XLIV, A, E), the brim constantly enlarging at the expense of the crown. During the “hat” stages the protoplasmic strands connecting the young male to the parent finally part, and the hat sometimes rolls over slightly, but the displacement is much less marked than in the case of the daughter colony.

As inversion continues, the crown of the hat gradually flattens out, the brim closes over the top, and usually the pore is completely obliterated (fig. 6, I to K ; Plate XLIV, B, C, F). Sometimes, however, mature globoids were seen which still had a pore, usually round in outline but sometimes either triangular or quadrilateral, in the centre of the upper surface. This was, however, not seen in young vigorous material, and is probably a sign of advancing senility in the strain or colony, or of untoward conditions.

#### 4. Maturation of Sperm Globoid within the Parent.

As soon as inversion is complete—before the pore has quite closed—the globoid begins to move, rotating slowly with a rocking of the polar axis, like a very flat top. The cilia are already long and soon attain their full length (Plate XLIV, G). At first the central hollow is broadly elliptical, but as development continues the globoid becomes more and more flattened until in side view the hollow is almost obliterated, appearing as a very narrow ellipse. The phialoporic upper surface is convex, the lower more or less flattened. The component cells are long and narrow with bluntly rounded ends, the apices are clear, the inner two-thirds filled with the fairly dark green chloroplasts, the line of demarcation between the outer colourless zone and the inner green zone being very clean cut (*cf.* Plate XLIV, C, F). This contrast between the inner and outer zones is very characteristic of recently inverted globoids, later becoming far less well defined (fig. 6, K, L).

Owing to the movement, photographs of living material cease to be possible as soon as inversion is completed—later stages have to be obtained from material which has first been killed. After an hour or two the globoid has reached its maximum depression, the chloroplast is more diffuse and lighter in colour, and the coloured zone is no longer sharply differentiated from the colourless outer zone but passes gradually into it. The component cells are more elongated, radiating from the central hollow, with very long cilia, the arrangement of which is very characteristic—from the centre of the under side they radiate out, those near the edge bending round it and upwards, while those of the upper surface stretch up in the direction of the phialoporic pole (fig. 6, L). Powers (1908, p. 164) gives an excellent description of the appearance and movement of the mature sperm globoid in *V. perglobator* which applies equally here. The pyrenoid in the base of the cell is small, oval in outline, and the nucleus elongated; the small eyespots are sometimes visible. The cilia are very much longer in proportion to the size of the cells than in the daughter colony (*cf.* Plate XXI, A). Soon after inversion a delicate wall is laid down on the outside; traces of the beginning of this wall may be seen in sections where the colourless ends of the sperms are edged with mucilaginous matter. So far as could be seen, no membranes separate the sperms nor bound the central hollow. Even the outer wall is very difficult to distinguish; it only becomes clear as the sperms are liberated.

During the development of the sperm globoid the vesicle formed from the wall of the mother-cell enlarges greatly, allowing ample room for the movement of the globoid within it. Not only does it remain intact throughout development, but even after the globoid has escaped the vesicle can be seen unbroken, except at the pore of escape. In fairly old male colonies such empty vesicles often show clearly among developing sperm globoids.

*Time taken for Inversion.*—It is very difficult to determine exactly when the preparatory stage begins, but it is clear that it is prolonged. There is apparently considerable variation in the time taken over inversion. For instance, in one case a male bundle came under observation when the lip was already rising. In 14 minutes it had straightened out and in another 80 minutes had completely inverted and started moving. This was unusually quick.

In another (Series X, shown in Plate XLIII, figs. A to K) when first observed the lip was already depressed but did not reach maximum depression for another 35 minutes. During the next 75 minutes it was slowly rising, finally straightening out. The opening of the pore to its widest extent (Thimble) took 1 hour 55 minutes, the actual inversion took another 1 hour 48 minutes—total, 5 hours 33 minutes.

After inversion is complete the final depressed form may be attained in from 45 minutes to an hour, or longer.

In several cases a given male bundle was under observation for over 6 hours, by the end of which time the globoid had started moving. To this time, however, must be added an unknown, probably varying, time for preparation before the bundle came under observation.

As a general rule, the process is very slow up to the "Thimble" stage; but once the pore has reached its maximum size, which corresponds with the minimum size of the bundle as a whole, and the lip has started to curl outward, the rate rises and the actual process of inversion takes place comparatively rapidly. In general the period of preparation lasts for at least 2 to 3 hours, often more, while the period of inversion proper takes another 1 to 3 hours, while after inversion is complete another hour or more elapses before the globoid has assumed its characteristic form.

### 5. *Escape of Sperm Globoid.*

After the globoid has reached the stage described above it remains within the parent colony for some time, exactly how long has not been determined. The movement which started as soon as inversion was



complete continues uninterruptedly; the globoid rotates on its axis, which at the same time is constantly changing its direction, the very characteristic peculiar compound motion resulting.

Eventually the sperm globoid, which measures from 40 to 44  $\mu$  in equatorial diameter and about half as much in polar diameter, is ready to escape. In general it escapes towards the outside, but a small number may escape inwards into the hollow centre of the mother colony, whence they may eventually escape whole through some pore already present, but more usually they break up into their constituent sperms within the body of the parent. Under normal conditions such cases are, however, exceptional.

As liberation approaches, the sperm globoid is seen to be moving in the outer part of the vesicle, which begins to bulge outward, pushing apart the neighbouring vegetative cells; the cilia bunch together into this bulge, a small part of the wall becomes disintegrated, suggesting strongly some form of enzyme action, and the sperm globoid squeezes through, often showing considerable distortion as it does so, but recovering immediately on reaching the outside. It reminds one strongly of the distortion seen in an *Oedogonium* zoospore during escape (Plate XLV, A, B).

There is no tearing of the neighbouring cells as in the escape of the larger daughter colonies, and after escape the cells fall back into position so that the gap left is merely the space in the peripheral layer originally occupied by the enlarged male initial cell. Further, the inner part of the vesicle remains intact, and thus, even when the majority of the sperm globoids have escaped, the parent colony is not laid open to attack from outside and remains healthy and vigorous. Since the escape of the several hundreds of globoids which such a colony may contain is spread over a considerable period, probably some days, this is an important consideration.

In the case of a single large male colony under observation for over an hour in the evening of 31st January 1931 the following observations were made:—

Between 10 and 10.30 p.m.—Six globoids were liberated outwards.

10.50 p.m.—One globoid escaped into the hollow of the parent.

10.55 p.m.—Watched a globoid escape at edge of colony—outer wall bulged slightly outwards, projecting part broke (or was digested) and the globoid squeezed through sideways, being considerably distorted in the process, but at once regained its normal shape.

11.5 p.m.—Another globoid escaped, this time without visible distortion.

The regular gaps left by escaped globoids are a very distinctive feature of maturing male colonies (*cf.* Plate XX, B).

#### 6. *Life of Globoid free in the Water—Escape of Sperms.*

As the globoid escapes, its rate of movement increases greatly and it moves here and there on the slide with great rapidity, rotating on its axis all the time. No phototactism was detected, nor could it be decided what caused change in direction. The energy used in movement must be enormous in proportion to the size of the individual cells (sperms), the cilia being much longer than the body of the sperm (fig. 7, D). Probably a great part of the food-store is consumed during this movement, but since the sperms contain chlorophyll, photosynthesis may continue during the free life.

The globoid may continue moving intact for some hours or the sperms may begin to escape almost at once. Apparently globoids liberated into the cavity of the parent break up more rapidly than those free in the water, but it is possible that in the cases observed this was due to exceptional sexual activity.

The surface of the mature globoid is divided very regularly into small, more or less hexagonal areas, formed by the anterior ends of the sperms, which are truncate, with the cilia inserted to one side (fig. 7, A). The first sign of breaking up is seen in a blurring of the outline of these divisions and a general loosening of the compact sperms. Strictly speaking, the liberation of the sperms is not a process of the *breaking up* of the globoid, but of the *escape* therefrom of the individual sperms; it must be remembered that the sperms are enclosed in a delicate membrane, and this can be seen partly or entirely empty as the sperms escape. The pore of escape is the pore of closure of the inverting male bundle. The exact mechanism of escape is very difficult to see, but appears to be as follows:—

The sperms draw their cilia back through the common membrane and can be seen actively moving about inside it (fig. 7, B; Plate XLV, C, D). This takes place gradually, and as long as any of the cilia still project they continue to move the globoid very actively, and usually before all are withdrawn a number of sperms have partially freed themselves, and in their endeavours to get quite free continue moving the whole mass—the globoids shown in these two figures were by no means quiescent and had to be killed before they

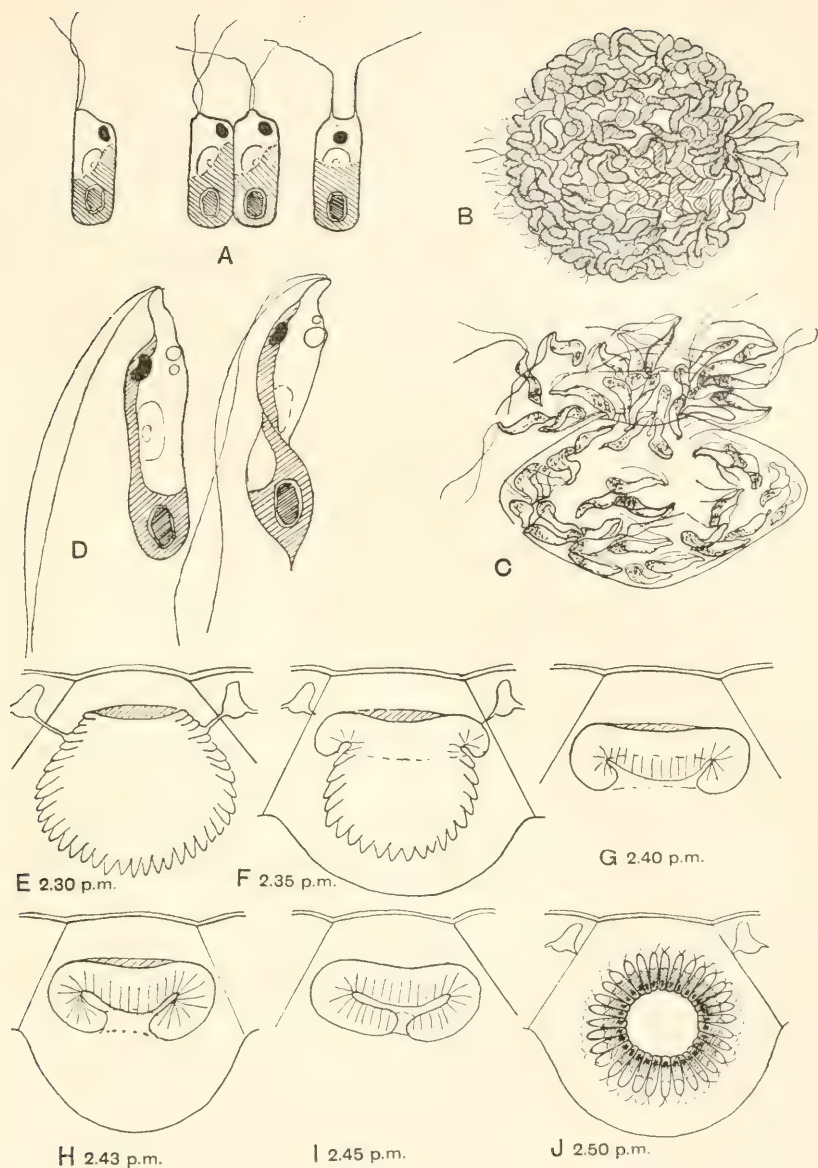


FIG. 7.—Development of sperm globoid (continued).

A–D, *V. Rousseletii*—A, Cells from recently inverted globoid; B, C, escape of the spermatozooids, B, beginning of escape, C, escape nearly complete, a few still swimming round inside the vesicle wall which is now distinguishable; D, spermatozooids. E–J, *V. capensis*—E–I, Inversion of sperm bundle showing position of the phialopore; J, globoid in surface view immediately after inversion, cilia lengthening.

A  $\times 1750$ ; B  $\times 800$ ; C  $\times 900$ ; D  $\times 3500$ ; E–J  $\times 750$ , all approximately.

could be photographed. Fig. C shows the sperms just beginning to escape; the majority of the cilia have been withdrawn, except near the pore, where a number of sperms are backing out of the globoid. As they do so they move actively in endeavouring to free their cilia.

Fig. D shows a globoid with a fair number of sperms already free, but the majority were still moving actively inside the globoid wall when the whole mass was fixed with iodine. As the sperms escape, the delicate wall of the globoid gradually becomes visible (Plate XLV, F), until, as it empties, its very characteristic form shows clearly (fig. 7, C); the upper surface becomes raised with the pore of escape in the centre, the lower surface remaining very slightly curved. The membrane is extremely delicate, and so far it has never yet been possible to distinguish it until the escape of the sperms is nearly complete.

#### *Structure of the Sperms.*

On escape from the globoid the sperms show great activity, moving about rapidly as soon as they have freed their long cilia from the mass of their fellows (Plate XLV, F, G).

The sperm (fig. 7, D) is an elongated narrowly pear- or spindle-shaped structure, with a long slender beak forming the anterior pole; this beak is apparently formed during escape, as in the globoid itself the anterior pole of the sperm is truncate, and the beak is already developed when the sperm emerges. The broader end is either rounded or pointed, both forms occurring side by side; probably the form of both ends alters as the spermatozoid moves about. The body of the sperm is  $2-4\ \mu$  wide, the total length  $10-12\ \mu$ , with cilia twice, or more than twice, that length. In the basal half is an elongated chloroplast containing a single small pyrenoid. Separately the sperms appear almost colourless, but in bulk they are seen to be a clear though somewhat pale yellowish green. The chloroplast has much the same structure as in the vegetative cell, *i.e.* a basal portion filling the posterior end of the cell and an elongation up the dorsal side of the cell apparently reaching to a short way below the base of the beak, where a small red eyespot is situated. In the hollow of the chloroplast, nearly central in the cell, lies the elongated nucleus, with a very small nucleolus, which can only be seen in prepared sections.\* Near the eyespot but on the clear ventral side of the sperm are two small contractile

\* Overton (1889, pp. 242-243) describes the sperm of *V. globator* as "more highly specialised" than that of *V. aureus* (*V. minor*)—elongated and without nucleolus.

vacuoles, the periods of which do not coincide, nor exactly alternate. With the oil-immersion lens they can be seen very clearly. Immediately above the position of the eyespot and vacuoles the sperm narrows suddenly to form the long, narrow hyaline beak, at the apex of which the two long cilia are inserted. They are directed backwards, and this fact probably gave rise in *V. globator* to the idea that the cilia are sometimes inserted laterally near the eyespot (Klein, 1890, p. 33, and Table III, fig. 23). The spiral twist often seen in the sperms is very apt to make it appear as though the cilia were inserted at the base of the beak (*cf.* the two central sperms in fig. G, Plate XLV), but in life in the African species it is quite evident that this is not the case; the insertion of the cilia is apical, or so nearly apical that it is impossible to detect the difference.

Except for the slight variation in the posterior end—either rounded or drawn out into a short point—and an equally slight one in the shape of the whole, the sperms are very uniform in size and form. Often the body has a slight spiral twist, apparently consequent on the rapid movement. The beak, sometimes equal to one-quarter the total length of the sperm, is an extraordinarily mobile structure, and seems to function in some way in the location and penetration of the oosphere.

Living sperms were watched inside female colonies, where they tend to collect round the egg-containing vesicles; probably owing to the greater viscosity of the mucilaginous fluid filling the cavity of the coenobium, the ciliary action so characteristic in water was seldom seen, the movement of the sperms being of an amoeboid type. The beak is constantly bending and turning, often apparently with a boring movement. They were often seen close to the vesicle surrounding an egg, the beak apparently trying to bore into the wall, while the cilia floated out motionless behind (fig. 8, B, C; Plate XLVI, A).

#### *Volvox capensis.*

In the main the above account of spermatogenesis in *V. Rousseletii* applies also to *V. capensis*, but there are several points where the process in the latter differs markedly from that in the former.

In the first place, the number of male initial cells is always very much smaller and the sexual colonies are always monoecious and protandrous. As a rule, the 8 primary antheridia develop more or less simultaneously, others often developing much later, but usually all are liberated before the oospheres are ready for fertilisation. As



a natural result, the range of stages of development seen in one colony is very much smaller than in *V. Rousseletii*.

Secondly, there are certain outstanding differences in development, the significance of which is difficult to understand: (1) The mother-cell passes through the period of enlargement with loss of cilia and subsequent down-sinking into the parent colony just as in *V. Rousseletii*, but *no change in the orientation of the cell constituents* follows; as a consequence the polar axis of the cell remains radial, the first two divisions take place in two radial planes at right angles to one another, and the phialopore is directed outwards (fig. 7, E), lying immediately below the parental pore formed by the sinking of the initial cell, and surrounded by the "perigonidial crown" of somatic plastids (Klein, 1889, p. 20).

Here and there a similar case is observed in *V. Rousseletii*, while, conversely, a shifting resulting in the pore being placed laterally is occasionally seen in *V. capensis*; but in general the above rule holds for the two species respectively.

At first it was thought that this curious divergence in development might be correlated with the direction of escape of the mature male globoid, that the shifting might result in a globoid which escaped outwards, while its absence resulted in a globoid which would eventually escape inwards into the hollow of the parent, and that it was consequently to be correlated with the distribution of the sexual cells, but there seems to be no evidence to support this view. In both species the rule is for the globoid to escape outwards into the surrounding medium and only exceptionally inwards into the parent. Further, since the parent vesicle which encloses the mature male globoid is amply large enough for it to rotate freely within it, there seems no reason for the orientation of the globoid during development to determine the direction of escape.

(2) Possibly the difference of position may be connected with the second divergence in behaviour—this is in the *rate* at which inversion proceeds. As yet inversion has only been watched in comparatively few cases in *V. capensis*, but in every case it was found that the rate of inversion was far more rapid than in *V. Rousseletii*; whereas in that species the stages from the opening of the pore to completion of inversion took from forty-five minutes to two hours or more, in *V. capensis* they are usually completed in under half an hour, and although the process follows similar lines the successive "hat" stages were not nearly so clearly defined (fig. 7, E-J). It is possible that the position of the connecting strands relative to the phialopore

may have something to do with this difference in the rate of inversion. As far as could be made out, the number of sperms forming the globoid is the same in the two species, so that difference in number is not the cause of the difference in rate of inversion.

(3) The mature globoid is similar in size and appearance to that of *V. Rousseletii*, except that, as a rule, it is not quite so much depressed, and the central hollow as a consequence is wider as seen in side view, and, further, the sperms appear to be somewhat less tightly packed (*cf.* Plate XV, C, D, and Plate XXI, A, B).

In one case accidental crushing of a sperm globoid directly after inversion resulted in the partial separation of the constituent cells, the structure of which was thus well seen (*cf.* fig. 7, A). The outline is oblong, ends truncate, slightly rounded, cilia inserted to one side of the anterior end, eyespot and nucleus near the clear end, the massive, slightly oblique chloroplast with pyrenoid filling up the posterior two-thirds. As the globoid ages, the form of the component cells gradually approximates to that of the mature sperms. In a mature globoid,  $42\ \mu$  in diameter, the central hollow seen in optical equatorial section measured  $20\ \mu$ , the sperm cells  $10\ \mu$ —after liberation the sperms are longer by the length of the beak,  $2\text{--}3\ \mu$ —while the nucleus is placed centrally.

### C. The Female Initial Cell—Oogonium Mother-cell, or Gynogonidium.

1. *Enlargement.*—The very young female initial cell (fig. 8, A) is similar to the gonidium and male initial at the same stage. But very early in development, while still ciliate, it becomes distinguished from them by the deepening of its colour to a strong dark green. This shows well in the photograph of portions of a male and a female colony of *V. Rousseletii* lying side by side (Plate XXXIX, E). In the female colony are several mature oospheres seen in surface view and a younger one in side view, with its apex very near the outer membrane, while in the male colony are two young undivided antheridium mother-cells, one seen side view, the other surface, showing the nucleolus, and a mature sperm globoid in surface view.

As the oosphere enlarges (fig. 8, B, C), the posterior portion projects further into the hollow of the parent, the apex remains near the surface, and the whole in general becomes distinctly flask-shaped (Plate XXI, D), though the shape varies a good deal. The neck of the flask is sometimes very much shorter and broader than the one here shown. In general, in *V. Rousseletii* the oosphere

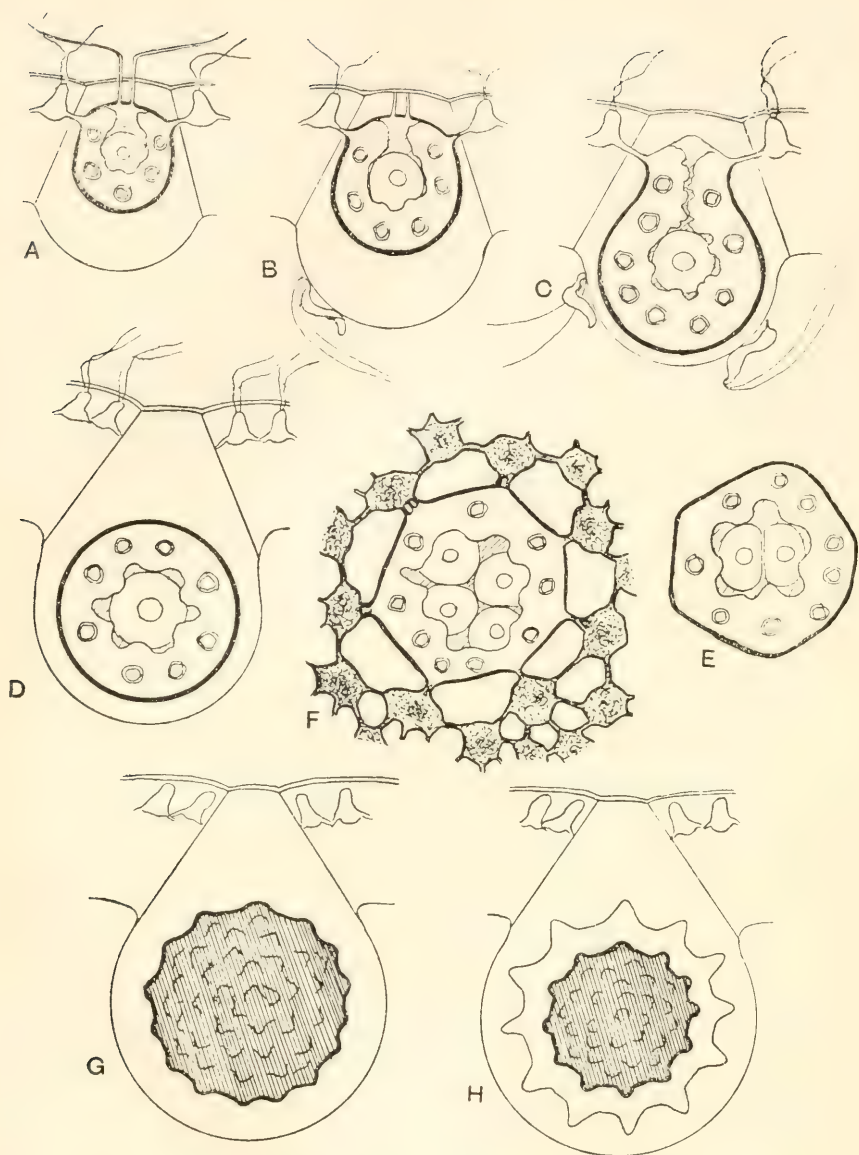


FIG. 8.—*V. Rousseletii*. Development of the oospore.

A, Female initial cell enlarging, still ciliate; B, enlargement continuing, cilia lost; C, nearly mature oosphere in side view; in B and C spermatozooids are shown in the hollow of the parent colony outside the oogonium vesicle; D, oospore sunk within peripheral layer; E, F, 2- and 4-celled oospheres; in F the surrounding parent cells are shaded; G, H, formation of the spiny exospore; in H the fixation has caused the dark green protoplast to shrink away from the outer wall which it is secreting and which is still thin and delicate.

All  $\times$  about 1000.

has a narrower, more elongated neck than in *V. capensis* (Plate XVI, D), but this is not always the case. The pyrenoids become very numerous and the whole structure so dense that it is only by very careful focussing, and then by no means always, that it is possible to distinguish the large central nucleus. A small area at the apex remains clear, and in this it is sometimes possible to see one or two small contractile vacuoles. The cilia are retained well into the period of enlargement; when they are eventually lost the two basal portions are distinguishable for some time between the outer membrane and the apex of the oosphere (fig. 8, B). The protoplasmic connections between the oosphere and the neighbouring cells are usually attached to the upper angle of the neck.

2. *Structure of the Mature Oosphere.*—When mature, *i.e.* ready for fertilisation, the oosphere is a massive, flask-shaped body, the neck of the flask projecting between the neighbouring cells to within a short distance of the outer membrane, the enlarged base protruding into the hollow of the parent, enclosed in the delicate vesicle formed by the much enlarged wall of the mother-cell. The bulk of the oosphere is intensely dark green, the large central nucleus almost enclosed in the massive, bowl-shaped chloroplast, very rich in chlorophyll and containing a large number of pyrenoids; the nucleolus is large and conspicuous. There is a large reserve of food, chiefly starch and fatty oils. The apex remains clear and has all the appearance of a receptive spot. In addition to the apical contractile vacuoles, others in the basal part may sometimes be seen, but such vacuoles in a healthy oosphere are comparatively small and rare; much vacuolation is usually a pathological sign. In surface view the oosphere is circular and about  $30\ \mu$  in diameter (Plate XLVI, A).

#### *Homologies of the Reproductive Cells.*

From the foregoing it is clear that the three types of reproductive cells, the gonidium and the sexual initial cells, are similar in origin, in structure, and in the first stages of development, but very early in the latter divergences appear. In the case of the gonidium and the male initial cell, however, development continues on similar lines right up to the formation of the sperm globoid which is essentially similar in structure to the asexual colony but smaller, resulting from fewer successive cell-divisions; as in the embryo colony, inversion is followed by the secretion of a common envelope, formed from the fused outer portions of the cell-walls. Whether here, too, these walls are continuous round the protoplasts could not be deter-



mined—if so, then they disintegrate before or during the liberation of the spermatozooids. As is the case with the daughter colony, so with the sperm globoid, the whole structure when mature escapes into the surrounding water and there assumes an active independent life. But the end result is different, since, whereas the embryo colony consists of both somatic and reproductive cells, the sperm globoid is composed of reproductive cells (the male gametes) only, and these, after escape from the globoid, lead for a brief period an independent flagellate life which must, however, soon terminate in fusion with a female gamete, or they perish.

From the initial similarity many workers, notably Klein in his later work (1889*b*, p. 47) and Janet (1912, p. 78 ; 1923, p. 55) believe the three types of cells to be homologous, and the sperm bundle homologous to the coenobium, regarding it as a dwarf male colony composed of cells each of which functions as an antheridium, producing a single spermatozoid. Janet, as is only logical, extends the homology to the oosphere, regarding it as a colony in which cell-division has been partially or entirely suppressed. He considers that either the content of the gynogonidium may round off without division to form a single large oosphere or female gamete, and that this is probably the case in *V. aureus* (1923, p. 58), or that a certain number of divisions may take place as a result of which one nucleus only persists, and, surrounded by the bulk of the cytoplasm, develops into the oosphere, while the remaining nuclei abort. This he believes to be the case in *V. globator*, where he found surrounding the oosphere a “follicle” of about 63 chromatic bodies which he regarded as abortive nuclei, the whole corresponding to a colony formed by six successive nuclear divisions, *i.e.* he holds that in this species there is a “blastéa oosphérique” as well as a “blastéa spermienne” (1923, p. 57). As against this view it may be remarked that other considerations point to *V. globator* being more highly evolved than *V. aureus*, and that therefore one would expect to find traces of such a reduced “female colony” in the latter rather than in the former species. Further, as yet no trace of such nuclei has been found in microtomed sections of either of the two South African species in question, and these are undoubtedly very close to *V. globator*. On the other hand, however, on several occasions living oospheres of *V. Roussetii* with two or four equal-sized nuclei have been observed—as, for example, in material from Rietfontein culture on 28th April 1931 (fig. 8, E, F), while in microtomed sections oospores with two nuclei of equal size are not uncommon. But quite different interpretations



of these phenomena are possible—the former may quite conceivably be cases of parthenogenetic development *in situ* of unfertilised oospheres such as is recorded by Overton (1889, p. 32) and Klein (1890, p. 23), while the latter may be fertilised eggs in which fusion of the male and female nuclei has been delayed.

Other workers—for example, Cohn (1875, p. 170), Overton (1889, p. 245), Zimmermann (1921, p. 275), and Fritsch (1927, p. 81, and MS.)—take a different view of the homologies of the reproductive cells. Although similar in origin they do not consider them homologous to the gonidium, since the ultimate products of their development are different. These workers regard the male and female initial cells as the mother-cells of the antheridium and oogonium respectively, the contents of the former dividing repeatedly to form the sperm bundle, while the latter, without division, forms an oogonium containing a single large oosphere. In the latter case this view presents no difficulty—the *Volvox* oogonium is comparable with the equivalent structures found elsewhere among the algae, where a single cell becomes more or less flask-shaped and the contents, enormously enlarged with food reserve, after union with a male gamete clothe themselves with a several-layered wall and form a zygote. In the case of the “antheridium,” however, the matter is not so simple, since here not only do the contents of the mother-cell divide repeatedly, but the mass of cells so formed undergoes very complicated developmental processes, at the end of which it clothes itself with a delicate wall, escapes from the parent, and for a time leads an independent existence. If, therefore, this view is accepted, we have under consideration an antheridium of quite exceptional type differing in several ways from all other antheridia. As, however, the forms included under the general name *Volvox* constitute a very highly specialised group, standing in many ways by itself as the culminating point of one line of evolution, and showing several characteristics which are found nowhere else among plants, notably the formation of asexual reproductive cells (gonidia) which develop *in situ* to form embryo colonies, it is not surprising if they also show peculiarities in the formation of their sexual organs.

Accepting the latter interpretation, then, the whole structure derived from the initial cell, including the much enlarged wall or vesicle, constitutes a highly specialised antheridium in which the contents form a mass of spermatozooids, the sperm bundle; this for a time acts as a unit, and as such leads an independent life. In the species of the *Eu-Volvox* section the term “globoid” suggested

by Powers (1908, p. 164) in the case of *V. perglobator* is descriptive and appropriate.

### *Fertilisation.*

Unfortunately the behaviour of the sperms has not been observed except immediately after liberation. No authentic case of sperm attraction by oospheres has been seen nor any entry of sperms into female colonies, although they have often been seen already inside such colonies. Hence the act of fertilisation in *Volvox* still remains a mystery.

Sperms have been watched repeatedly inside both monoecious and dioecious colonies (*i.e.* in both *V. capensis* and *V. Rousseletii*); in many such cases the sperms were moving about and apparently trying to effect an entrance through the vesicle wall (fig. 8, B, C). This seems to be a very common state of things, as it was observed in *V. globator* by many of the earlier workers, *e.g.* Cohn (1875, p. 104), Klein (1889*b*, pp. 35–36). But although many observers have watched sperms inside the colony apparently swarming round young oospheres, no one has as yet recorded the entrance of the sperm into the oosphere in any such case (Mainx, 1929, p. 210). Klein mentions that he frequently found dead sperms within colonies with ripening oospores.

*A priori* it seems contrary to expectation that sperms liberated into the water should have to penetrate the massive parent colony, and thus make their way to the back of the oosphere while all the said oospheres have their anterior ends (where in general throughout many groups of oogamous plants receptivity is localised) so near the surface of the parent that penetration there must be at least as easy as, probably much easier than, entry into the parent. Further, subsequent to inversion of the colony the phialopore in general closes completely, leaving no traceable pore which could serve as the regular means of entry for the sperms, such as the "polar plateau" described by Overton (1889, p. 243) in the case of *V. aureus*. It is true that in *V. capensis* as in *V. globator* there are always the gaps left by escaped sperm globoids, and that these gaps are always in the midst of developing oospheres, yet they must be regarded as more or less fortuitous, and, moreover, are generally closed on the inside by the empty vesicle of the escaped globoid.

From consideration of the structure of the colony and oosphere, then, the expectation is that fertilisation should take place from the outside, entry being effected at the apex of the oosphere. Moreover,

after fertilisation the oosphere rounds off completely, the connecting strands disappear, the neck is withdrawn, and the oosphere lies completely within the peripheral layer of the parent (fig. 8, D). On the other hand, as yet there are no observations of the entry of sperms into the egg (or rather oosphere) to confirm or refute the justice of this expectation, while there is abundant evidence to suggest that the sperm enters the hollow of the parent, and thence penetrates the oosphere.

The only two workers who describe male nuclei within the oosphere are Overton (1889, pp. 245-246, t. iv, fig. 29) and C. Lander (1929, p. 434, pl. xv, figs. 4-17), and in neither case is the evidence given convincing, and it appears at least possible that in both cases what the observer actually saw were binucleate oospheres such as those described above and not sperms entering the oosphere, and this for the following reasons:—

1. Overton, describing and figuring sperms, lays stress on the fact that in *V. globator* the sperm nucleus contains no nucleolus (1889, pp. 245-246, t. iv, fig. 29), yet in his drawing of a fertilised oosphere (fig. 29) he shows the male nucleus as a body of diameter about equal to a third that of the female nucleus, with a large well-defined nucleolus.

2. In Miss Lander's paper, again, whereas her drawing of a sperm (fig. 11) shows it as possessing a very small nucleus with minute nucleolus, the drawings showing the supposed male nucleus within the oosphere depict it as much larger than the whole spermatozoid, about two-thirds the size of the large female nucleus, and with a nucleolus which is only a little smaller than that of the oosphere (figs. 13-16). Here, too, it seems possible that she is figuring stages in the division of an oosphere nucleus, and not a case of fertilisation. Further, her drawing of the pore by which the sperm is said to gain entrance to the lateral receptive spot is far from conclusive—it has very much the appearance of a tangential section of a sperm adpressed to the oogonium wall.

Careful search has been made for similar structures in both living and sectioned material of these two African species, so far without success: two doubtful cases were found where the wall of the oogonium in a corresponding position showed some unevenness, but compared with the hundreds of healthy normal oogonia which showed no trace of any such structures their value is negligible.

These two authors may be quite correct in their observations on fertilisation, but as yet, apart from the very common occurrence of

sperms inside the parent colony, no evidence in the African material has been found to support them. Probably this is a case where prolonged and careful observations of suitable living material will reveal the true story.

So far, then, this investigation adds nothing to our knowledge of the process of fertilisation. The present position may be summed up as follows :—

1. In *V. Rousseletii* in general the male globoids are produced in great numbers in separate colonies from the eggs, very occasionally one or two appearing in preponderatingly female colonies. In *V. capensis* a comparatively small number of male globoids (5 to 22) are produced in the same colony as the oospheres; always where the colonies are monoecious they are strongly protandrous.

2. In both species male globoids are liberated outwards, and eventually dissociate in the water; more rarely liberation takes place inwards, and dissociation follows within the body of the parent colony.

3. The apex of the flask-shaped oosphere remains near the surface of the parent colony, and has the appearance of a receptive spot.

4. Later, presumably after fertilisation, the neck of the oosphere is withdrawn, the oospore rounds off, clothes itself with a several-layered wall, and is deep sunk within the parent.

5. Sperms are frequently found in both species within the colony, apparently swarming round young oospheres and endeavouring to penetrate the surrounding vesicle.

6. No posterior pore can be detected in the parent colony after the closure of the phialopore.

From these facts the following deductions can be made :—

(a) If fertilisation takes place it must in general be cross fertilisation, since ripe oospheres and mature sperm bundles are very rarely met with in one and the same colony even if monoecious.

(b) Judging from the behaviour of the oospheres, fertilisation from without *via* the neck of the oosphere would seem probable, but at present there is no further evidence of such being the case, while the frequent presence of sperms within the colony indicates that by some means the sperms penetrate into the hollow of the parent colony, and may thence enter the oosphere by the broad basal part.

Overton, by means of isolation experiments (1889, p. 245), demonstrated that in *V. globator* self-fertilisation could take place, and he held that self-fertilisation was usual, a conclusion with which Klein



disagrees (1890, p. 35). Apparently Overton's experiments with *V. globator* have not been repeated by any later investigator. Mainx (1929, p. 210) found that parthenogenetic development of eggs is a common phenomenon in *V. aureus*, and possibly the same may be the case here, but considering the large number and vigorous nature of the sperms one is chary of adopting such a view. It is possible that a closer study of germinating oospores will provide a criterion for determining whether a resting spore is in truth a zygote or only a parthenospore. The need for observations and experiments with living material is very obvious in this connection.

#### *Development of Oospore subsequent to Fertilisation.*

As already stated, at a certain stage of development, presumably after fertilisation, the oospore rounds itself off and sinks further into the parent until it lies well within the peripheral layers; at first a marked enlargement takes place, and since at this time all protoplasmic connection with the parent has ceased, this enlargement must be due to the photosynthetic activity of the egg itself. Soon integuments begin to form within the oogonium vesicle. The oospore first lays down the spiny outer coat—the outline of the dense green protoplast becomes uneven (fig. 8, G), spirally arranged portions project, and over them the conical spines of the outer coat form. At the base of each of these projections is usually a pyrenoid. In living material the green core of each spine can often be very beautifully seen; in formalin-fixed material the green core may often shrink away from the colourless integument, the green projections corresponding to the outer spines then showing very clearly (fig. 8, H).

When the spines have about reached their maximum size the green projections are withdrawn, the protoplast rounds off, and the inner coats are formed. These consist of a relatively thick, smooth, outer coat, the mesospore, and a very delicate inner wall or limiting layer, the endospore, surrounding the protoplast; as a rule the latter does not become apparent till later in the history of the oospore. Janet (1912, p. 99) distinguishes only two layers in *V. globator*, the spiny exine (exospore) and a single intine (endospore), but he evidently never saw oospores germinating, when the double nature of the inner coat would have become apparent (*cf.* Plate XLVI, G, H).

After the formation of the integuments the colour of the oospore begins to change—the intense bright green gradually changes to a reddish gold and ultimately to golden brown, the chlorophyll being



replaced or masked by Haematochrome. Colonies containing ripe oospores present a very beautiful appearance macroscopically—placed in a small glass tube and held up to the light so that the sunlight is reflected off the rapidly moving spheroids, those with ripe oospores appear bright golden red among the bright green of the other colonies.

The oospore contains large food reserves, chiefly of starch in the outer layers, volutin and fatty substances in the inner. Sections show the large central nucleus connected by a network of protoplasmic strands with the outer layers of the cytoplasm occupied by the massive chloroplast and the numerous pyrenoids.

#### *Size and Appearance of the Oospore in the Two Species.*

The above general account applies equally to both *V. Rousseletii* and *V. capensis*, but the mature oospores in the two differ considerably in appearance. In *V. Rousseletii* the spines are usually longer, rather more slender and sharply pointed, and with rather more tendency to hooked ends than in *V. capensis*. The limits of size, including spines, is much the same in the two species; if anything, the oospore of *V. capensis* is rather larger than that of *V. Rousseletii* (*V. capensis* 49 to 62  $\mu$ , *V. Rousseletii* 46 to 58  $\mu$ ), so that when allowance is made for the greater length of the spines in the latter the actual spore, the part contained within the mesospore, is a good deal greater in *V. capensis* (*V. capensis* 40 to 49  $\mu$ , *V. Rousseletii* 35 to 43  $\mu$ ).

The differences in appearance and structure, difficult to define in words, are well brought out in the photographs of separate spores and spores *in situ* shown in figs. E, F, Plate XV, and figs. C, E, Plate XXI. They are mainly differences of degree; length and shape of the spines may vary considerably within one colony, but whereas in *V. Rousseletii* they vary about the type shown in fig. C, Plate XXI, in *V. capensis* they vary about the type of fig. F, Plate XV. One spore of *V. Rousseletii* may, for instance, have less well-developed spines than its neighbours, and consequently approach the *capensis* type, but on the whole the appearance is quite distinctive.

In *V. capensis*, even at the height of its development, there are rarely found a very large number of colonies containing ripe oospores, whereas in *V. Rousseletii* during sexual activity a very great proportion of red colonies, *i.e.* females with ripe oospores, may be found. It would appear that in *V. capensis* the ripening oospores are not retained so long within the colony as in *V. Rousseletii*, that very soon after the colour has changed the colonies disintegrate and the ripening

process continues at the bottom of the pool, whereas in *V. Rousseletii* the ripening oospores are retained much longer in the parent colony, which moves about among the others retaining its firm outline and shape for a considerable period before disintegration finally takes place.

Very occasionally in *V. capensis* abnormal oospores with thick smooth walls were seen in specially active material during unusually hot weather (Plate XXXIX, F).

### *Liberation of the Oospores.*

The method of liberation of the oospores is sharply contrasted with that of either the sperm globoids or daughter colonies. In both the latter the liberation was, as it were, a voluntary act on the part of the young organ. The oospores, on the other hand, are entirely passive. When the requisite degree of ripeness is reached the whole parent colony disintegrates, sometimes very rapidly; the protoplasts fall apart and the membranes apparently dissolve.

A single colony of *V. capensis* which contained reddened oospores had apparently reached the limit of its life, for when placed on the slide it collapsed under its own weight and disintegrated, liberating the oospores; it had not been killed nor fixed in any way, nor had it had the pressure of a cover-slip on it. No similar case has been observed in *V. Rousseletii*, but probably a similar breaking up takes place there, although more slowly.

There are several indications that the oospores have not reached full maturity when this takes place, but continue to mature in the mud at the bottom of the pool. The speed with which maturity is reached appears to vary considerably, largely depending on external conditions, of which temperature is certainly one of the most important. The observations on a form of *V. Rousseletii* at Kimberley, already recorded (Pocock, p. 499), show that there maturation is very rapid, sometimes at any rate complete within two or three weeks.

It is evident that the oospores are very efficiently protected and able to retain their viability for a number of years. In 1928 *Volvox capensis* was found in large quantities in shallow pools inside wattle scrub near Dabchick Vlei; the two succeeding winters were dry, and no pools formed in this spot, but in 1931 one pool partly filled and *Volvox* Juveniles promptly appeared. The pool soon dried up, however, and no sexual colonies were found. In 1932 a very much larger area of the thicket was inundated, far more than in 1928, and

over practically the whole area *Volvox* was soon abundant, the colonies being exceptionally large for this species. Obviously the oospores had retained their viability for three and four years respectively. That the spiny outer coat is an excellent protection against attack by small animal organisms became very apparent in the oospore culture experiments described below—while the smooth, round spores after escape from the spiny coat were repeatedly seen in the alimentary canals of *Paramoecium* and various small worms, complete spores were never so observed.

*Subsequent Development of the Oospore in V. Rousseletii and V. capensis.*

When one considers that the average adult colony in either of these two species contains between 20 and 30 thousand cells, the product of some 14 or 15 successive cell-divisions, that the oospore, including the spiny covering, measures only some 50 to 60  $\mu$  and the actual spore-protoplast only about 44  $\mu$ , that the spore is free in the soil at the bottom of the water and must contain sufficient food stored within it to carry the young colony through all the stages of cell-division and subsequent development, until it reaches the motile state, it seems difficult to conceive of such a colony being produced directly from division of the oospore. Apart from the question of size, the risk of injury or destruction would be enormously increased if development were prolonged. Evidently the germination processes must be rapid, for within 4 or 5 days of the forming of a pool, well-developed *Volvox* colonies may be found.

*Discovery of the Juvenile Form.*

In May 1931 at the beginning of the month there were several showers, sufficient to moisten the earth on the Cape Flats but not to form pools. About 11th May further rain fell, and pools formed on the grassy common which is bounded on two sides by Belvedere and Keurboom Roads. Near Keurboom Road one elongated depression annually forms a pretty little vlei,\* usually producing much *Volvox*. On 15th May this was visited and found to contain a small pool of water. The use of the collecting net revealed the presence of fair-sized colonies of *Volvox* and also, particularly from one spot,

\* Unfortunately soon to be a thing of the past, as it lies within the boundaries of what is now Ackerman's Sports ground, and is being filled in.

quantities of very minute green motile bodies individually only just visible to the naked eye, but fairly clear in bulk. Examined microscopically, the collection was found to contain, in addition to typical Flats *Volvox* in young stages (some with inverting daughters) and a great deal of very beautiful *Eudorina*, a third type of motile green spheroid, which was at first sight taken for a new species of *Volvox* with very few large cells (Plate XLIX, A). But in these tiny spheroids were one or occasionally two (very rarely three) well-developed daughter colonies of the same type and very nearly as large as those found in typical colonies of *V. capensis*; one of the larger of these small colonies measured  $284 \times 292 \mu$ , and contained a single large daughter,  $151 \times 155 \mu$ , rotating within it. Hence it was concluded that these beautiful little spheroids were the product of the germination of oospores of *V. capensis*.

These "Juvenile" forms are always small, composed of 256 to 512 cells or thereabouts, the component cells being very much larger and more widely spaced than in the adult form, but otherwise similar (Plate XLVIII, E, F). A more detailed description of the Juvenile is given below (p. 625). Later in the season similar Juveniles were collected at Dabchick Vlei, and one or two were seen in preserved material from Rhodesia, while quite recently they have been collected in enormous numbers in the case of *V. Rousseletii* at Kimberley.

Although the evidence was strong that the supposition as to their true nature was correct, it was most satisfactory to have it proved beyond a doubt when ripe spores of the Rietfontein material were obtained in masses and by suitable methods induced to germinate. As a result, Juveniles of exactly the same type as those collected from the Cape Flats were produced (Plate XLVII, H-L; Plate XLVIII, A-D). The results of these germination experiments were extremely interesting, and proved to be what might be expected from the study of the life-history of the nearest *Volvox* allies, *Pleodorina*, *Eudorina*, etc., as revealed by the work of recent investigators such as Hartmann (1918) and Schreiber (1925), but contrary to the published accounts of the behaviour of *Volvox*.

#### *Development of Oospore subsequent to Liberation.*

Since at liberation the oospores, in some cases at any rate, are not quite ripe, the process of maturation continues in the water and is probably assisted by subsequent drying. Apparently temperature is an important factor in the process. When fully ripe the oospore



is a deep golden brown, and if it has been dried the protoplast enclosed in the delicate endospore is usually contracted away from the mesospore and often placed somewhat eccentrically in it, separated from it by a clear space.

A more or less prolonged resting period may intervene before germination, or the oospore may germinate immediately. Here external conditions appear to be of paramount importance, always allowing, however, for some individual idiosyncrasy of the oospores. During the resting period no further change takes place in the appearance of the oospores.

#### *Collection of Oospores.*

For obtaining ripe oospores for germination experiments, *V. Rousseletii* affords extremely favourable material—not only does it contain more oospores per colony than *V. capensis* but female colonies are produced in larger numbers and retain the ripening oospores to an advanced stage before disintegrating. In February 1931 Mr. Steer's Rietfontein cultures provided particularly rich sexual material in an advanced stage of development, hence with abundance of ripe or nearly ripe oospores. A quantity of this material was placed in an old glass battery jar 5 inches square, half filled with water. As the female colonies ripened and disintegrated, the oospores collected at the bottom of the jar as a red-brown sediment; the bulk of the soft part of the detritus was consumed by various organisms, chiefly rotifers and *Paramoecium*. The spiny coats of the oospores evidently form an efficient protection, since complete oospores were never seen inside these voracious little creatures, whereas after germination had begun and the spore enclosed in the smooth inner wall had escaped from the spiny covering, the still undigested red-brown spores were frequently seen in the digestive organs, of *Paramoecium* in particular.

On 17th February some of the oospore sediment was placed on slides and put aside to dry. The rest was left untouched for some months. The jar stood near a window with a southern aspect, so that, though well lighted, direct sunlight never fell on it. The water gradually evaporated, but was never allowed to dry up completely.

#### *Culture Methods.*

Nothing further was done in the matter until the end of June; then germination experiments were started and carried on through July and August, when the supply of material was exhausted. These experiments were of four main types, and in each case both material



dried on the slide and material transferred direct from the stock bottle (*i.e.* without previous drying) were used :—

- (1) Oospores placed in tank-water \* and kept indoors.
- (2) Oospores placed in tank-water and placed outside in the sun.
- (3) Oospores placed in water obtained from *Volvox* vleis and strained, placed in the sun.
- (4) Oospores placed in pond-water plus a small quantity of culture solution (Uspenski and Uspenskaja, 1925, p. 397).

To prevent overheating and to reproduce as far as possible the conditions of lighting obtaining in the natural habitat, the small glass culture-dishes (2 to 4 inches in diameter, about 2 inches deep, wide open at the top) were sunk in a layer of garden soil in a large basin of water and the whole placed in a spot where the morning sun falls but which by noon is in shade.

From these four experiments the following results were obtained :—

No. 1 was practically barren of results ; a few eggs hatched out from their outer spiny coats, but did not develop further.

Of the three placed in sunlight, all yielded some Juveniles essentially similar to those collected on the Cape Flats, *i.e.* some at any rate of the oospores germinated completely.

In No. 2 no further stages were seen, but in Nos. 3 and 4 development continued to the second generation, possibly further.

The addition of small quantities of the culture solution was beneficial, but the use of the full strength solution did not give good results, causing pathological phenomena in the developing colonies.

For observation of the stages in germination the most convenient method on the whole was the placing of oospore material on slides and allowing it to dry out completely, subsequently immersing the whole slide in the culture medium. For observation the slide was lifted out and the material examined without disturbing it—with care cover-glasses can be used and later removed without injuring the material on the slide.

Although the culture experiments were aimed primarily at obtaining good germination stages and not at studying the conditions necessary for germination and were therefore not at all exactly carried out, the following facts emerged :—

1. Direct sunlight is necessary for the germination of the oospores. Two years previously oospores of *V. capensis* were kept in a jar of

\* The tank is filled by rain-water from the house-roof. Since Cape Town's ordinary water-supply is chlorinated before distribution from the reservoirs it is best to avoid using it in culture experiments.

vlei water for six months in a similar place to that in which the oospore stock jar stood, *i.e.* in a south window, where no direct sunlight ever fell. Other algae in the water flourished, but the *Volvox* oospores, though quite healthy, showed no signs of germination. Also the oospores in the stock bottle were in water, yet did not germinate.

2. Complete drying is not essential, but is beneficial. Oospores transferred direct from the stock bottle to the culture germinated in a few cases, but more oospores germinated if the material containing them had been completely dried, even if for a short time only, before being placed in culture. In one case oospores from the stock dish were put in a small dish and allowed to dry completely. The following day, 4th August 1931, water was added and the whole placed in the sun. The two succeeding days were wet and overcast, but were followed by two warm, sunny days; on 9th August the material contained many Juveniles, some free in the water, others still contained in the surrounding vesicle.

3. The oospores are not necessarily fully mature when liberated by the break up of the parent colony. In *V. capensis*, at any rate, they appear to need a further period in water before drying completely. In November 1931 colonies of *V. capensis* from Belvedere Road containing apparently ripe oospores, including one which was liberating the oospores by disintegrating (see p. 611), were placed on slides and allowed to dry. Two months later culture experiments were started, but all the oospores, most of which had remained bright red-gold in colour, disintegrated; a very few only which had turned dark golden brown showed early stages in germination, but developed no further. So far the oospores of *V. capensis* have not been successfully germinated, but everything points to the process there following exactly the same lines as in *V. Rousseletii*.

#### *Germination of the Oospore.*

The successive steps in germination are as follows:—

*Stage 1.*—The spiny episporic cracks and the spore enclosed in meso- and endo-spore either escapes into the water (Plate XLVI, B–F) to continue development free in the water, or more rarely remains more or less enclosed in the cracked episporic, developing within it (Plate XLVI, H).

On escape the spore consists of a deep golden-brown spore-body (protoplast), in the centre of which careful focussing sometimes reveals a single large nucleus, enclosed in a delicate limiting membrane

(the endospore) and lying more or less eccentrically in the hyaline, rather thick mesospore from which it is separated by a clear empty zone. The escaped spore is 31 to 35  $\mu$  in diameter, the brown content 27 to 31  $\mu$  (Plate XLVI, E).

*Stage 2.*—The spore content increases in size until it completely fills the mesospore (Plate XLVI, F); the contrast between the appearance at the beginning and end of this stage is well shown in the photograph. The size of the whole increases considerably. These two stages may sometimes be reversed, the enlargement taking place before escape from the spiny epispore (Plate XLVI, D), but in the majority of cases seen development proceeds in the order given. It is at this stage that the oospores are often consumed by paramoecium, worms, etc.; the comparatively thin-walled, immobile, spherical structures seem peculiarly vulnerable.

Probably during this period of enlargement reduction division takes place. In life, division of the nucleus has not as yet been detected, although spores have been seen with their contents divided into four. The spore now measures 35 to 40  $\mu$ .

*Stage 3.*—The mesospore splits and the delicate endospore protrudes, enlarging to form a vesicle into which the content of the spore passes. Usually this already shows the form of a large zoospore with clear, bluntly pointed anterior end (Plate XLVI, G); sometimes, however, more than one zoospore appears to be formed (Plate XLVI, H). This point has not as yet been cleared up, and it is possible that not more than one zoospore survives, although the appearance in the few such cases seen does not suggest this, as, for example, in the spore shown in this figure, where it certainly looks as if four equal sized zoospores were being formed. Such structures were far less common in the Rietfontein material than those of the type shown in Plate XLVI, G, and, with one possible exception, in these no traces of vestigial zoospores such as are found in *Eudorina*, etc. were seen.

*Stage 4.—Escape of Zoospore.*—The zoospore escapes from the endospore vesicle into the water, two cilia are emitted, and a delicate loose wall is formed at first close to the zoospore (Plate XLVI, I), later enlarging, and the zoospore begins to move about in the water, at first slowly, later with some rapidity (Plate XLVI, J).

#### *Structure of the Zoospore.*

The zoospore is a large *Chlamydomonas*-like structure, broadly ellipsoidal but slightly asymmetric in form, of a deep golden-brown colour, except at the clear bluntly pointed end and here and there

near the surface. The posterior half is slightly broader than the anterior, the pole broadly rounded. The chromoplast is massive, cup-shaped, and uniformly golden brown, except now and again at the edge where patches of green may show. The large nucleus with conspicuous round nucleolus rests in the hollow of the cup, approximately in the centre of the cell (fig. 9, A, B).

The zoospore is enclosed in a delicate hyaline wall which is at first closely adpressed to the protoplast (fig. 9, A), but soon enlarges to form a loose cover comparable to the vesicle surrounding a developing gonidium (fig. 9, B). At the anterior end, attached to the beak, which is very short and placed somewhat asymmetrically, are two cilia which diverge widely, penetrating the wall at two spots well apart from one another. Immediately after liberation the cilia are short but gradually lengthen until they are about as long as the zoospore. The whole organism is very like a large golden-brown *Chlamydomonas*, but with a loose wall which, so far as could be made out, is not connected to the protoplast by protoplasmic strands as in *Sphaerella* (*Haematococcus*), nor is the chloroplast like those usual in the latter genus. It is far more like the cup-shaped structure characteristic of *Chlamydomonas*, while the wall is similar to that seen in several species of this genus (cf. *C. angulosa* Dill, Pascher, 1927, pp. 231-232, *C. pteromoniodes* Chodat, *loc. cit.*, p. 208).

No eyespot could be detected, nor would one appear to be necessary, always assuming the eyespot to be the light-perceptive organ, since the work of the zoospore is primarily cell-division and not food-making, as it contains in itself sufficient food reserve to carry it over this first phase in its existence. Nothing, therefore, would be gained by the zoospore moving towards the light. On the contrary, such action on its part would probably increase the danger of destruction. So far as could be determined throughout its existence as a free unicellular organism and well into the period of division it moves about on the floor of the pool in which it lives (in cultures on the surface of the slide), its power of movement undoubtedly acting as a means of protection against predatory animal organisms.

Soon after liberation the zoospore measures about  $30 \times 40 \mu$ ; it enlarges slightly as it ages—an hour later the same zoospore measured  $36 \times 46 \mu$  (*i.e.* in both cases, the protoplast, not including the loose cell-wall). The enlargement appears to be due to a decrease in the density of the protoplast, which becomes slightly lighter in colour, particularly at the surface, where the green patches may begin to extend.



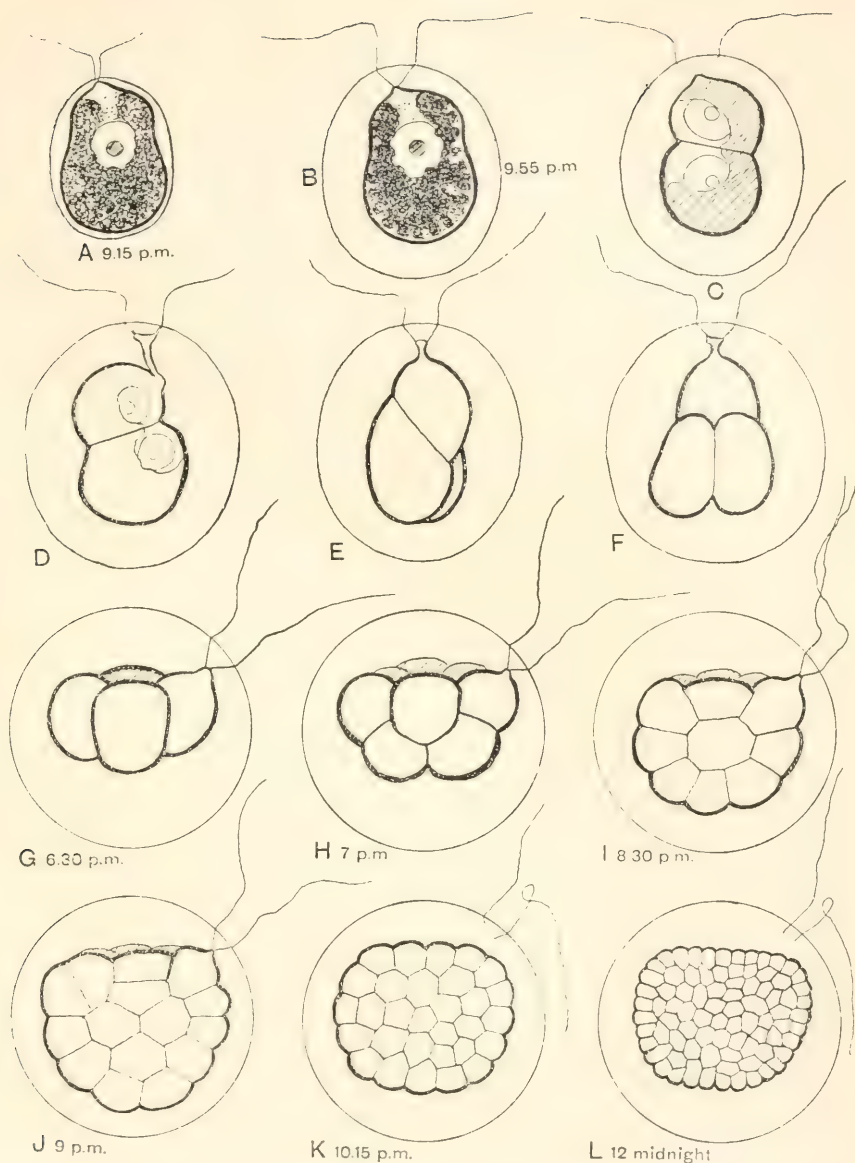


FIG. 9.—*V. Rousseletii*. The zoospore and its development.

A, Zoospore recently escaped from endospore (9.15 p.m.); B, the same zoospore forty minutes later; C, D, first division; in D the beak is drawn out into a hammer-shaped projection; E, F, side and ventral views respectively of a developing zoospore which shows unequal division; G–L, stages in division of a single germ colony, which remained motile until after the 32-celled stage was reached.

All  $\times$  about 500.



*Development of the Zoospore.*

(a) *Period of Cell-Division.*—The duration of the life of the zoospore as a unicellular organism is not long; soon cell-division commences and continues just as in the case of the male initial cell, except that the zoospore retains its cilia (*cf.* development of daughter colony in *Eudorina*, Pascher, 1927, p. 48), and continues motile until several successive divisions have taken place.

Apparently here, too, there is slight shifting of the polar axis of the cell; the protoplast is slightly oblique from the beginning, as the photographs suggest, and this obliquity appears to increase before division begins. In any case, the plane of the first division is not exactly longitudinal to the external form of the zoospore but slightly oblique, so that it does not pass through the beak. Hence one of the resultant cells retains the beak with the two cilia, the other cell is non-ciliate (fig. 9, C, D). Often the beak gets drawn out much as do the apical portions of cells near the posterior pole of an adult colony, so that the cilia are attached by a hammer-shaped protoplasmic protuberance to one of the cells derived from the zoospore (fig. 9, D to F). In some zoospores the first plane of division is uneven and the cilia-bearing cell is the smaller; when its sister cell next divides it remains undivided (fig. 9, E, F). In others the two first cells are apparently equal and divide again simultaneously, *e.g.* in the one whose development is shown in fig. 9, G to L, but here there are indications that in later divisions the cilia-bearing cell does not divide at the same rate as the others and is rather larger. The period during which movement continued varied considerably—in one case the developing colony moved actively right up to the 32-celled stage, but ceased to move before the next division was complete (fig. 9, K). In another, movement ceased after the second division and before the third was complete (*i.e.* at the end of the 4-celled stage). Probably the period is determined by the rate of division of the cilia-bearing cell. There must be a minimum size below which the cell is no longer capable of working the long cilia; hence, if the cilia-bearing cell remains larger than its sister-cells, the period may be prolonged, whereas if it divides at the same rate its size rapidly decreases and movement ceases correspondingly early. The cilia may remain attached to the cell for a time, but eventually become disconnected; even when the young colony is fully formed and rotating within the vesicle the cilia may still be seen attached to the latter, often “frozen” in a spiral twist. This was the case in the young colony which was

the first sign of germination observed in the cultures (Plate XLVII, G) and was in itself a sufficiently startling discovery.

Cell-division proceeds apace, one division following another in rapid succession. It differs from that of the male initial cell and still more from that of the gonidium in that there is no increase in size, the resultant colony when fully formed being scarcely larger than the zoospore-protoplast and, moreover, being hollow.

The number of cells produced varies. Sometimes there may be as many as nine successive divisions resulting in about 500 cells; in the majority of cases, however, there are eight divisions giving about 240 cells, occasionally not more than seven when the number of cells is just under 128 (Plate XLVII, L)—always, apparently, slightly fewer than the corresponding power of 2, which would be accounted for by the failure of the cilia-bearing cell to participate in one or two divisions before movement ceases, and later possibly by gonidia-formation at the time of one of the last divisions.

On 4th September 1931 material collected near Dabchick Vlei, Cape Flats, in the wattle-scrub pool, yielded numerous Juveniles, all extraordinary uniform in size and cell number. Repeated counts gave the cell number usually as under 256 but much above 128 (*e.g.* 196, 209). In the oospore cultures there was much less uniformity—while some (*cf.* Plate XLVIII, C) were like these “wild” Juveniles, others varied considerably (*cf.* Plate XLVII, H to L).

Cell-division proceeds without a pause, and may be complete within six hours. The germ colony of which the final stages in development were photographed (Plate XLVII, A to F) came under observation at 6.30 p.m., when it was already in the 4-celled stage (fig. 9, G); it was moving about fairly vigorously but with a somewhat restricted range. It was kept under observation through the night until 3.17 a.m., by which time it had completed cell-division, inverted and emitted cilia, and was rotating within the vesicle to which the long cilia of the zoospore were still attached. Unfortunately at this stage it was lost, so that the mode of escape from the vesicle was not observed. The length of the life of the zoospore as such is unknown—probably not long, possibly at the outside 24 hours, probably not more than 2 or 3 hours.\* After the 4-celled colony was first seen successive cell-divisions followed one another rapidly, at intervals of about an hour; at 9 p.m.

\* In one culture experiment germ colonies enclosed in the zoospore vesicle were obtained the evening of the day after that on which the experiment was started, *i.e.* in less than thirty-six hours. See Appendix, Oospore Culture, I.

the 32-celled stage had been reached, the whole still being motile, but by the time the next cell-division had taken place it had become quiescent, and the cilia, though still attached to the vesicle wall, were no longer connected with the cell protoplasts. Owing to the smallness and density of the dark golden-brown spheroid it was difficult to determine with certainty when division was actually completed, since the last one or two divisions made little difference in its appearance. It was certainly complete very soon after, if not before, midnight, but from 10.30 p.m. onwards the form of the colony showed very little change. Apparently between 10.15 p.m. and 12.30 a.m. there were two more divisions, making eight in all—six divisions between 6.30 p.m. and midnight giving an average rate of one cell-division per hour. Fig. 9, G to L, shows diagrammatically the appearance of the colony at 6.30, 7.0, 8.30, 9.0, 10.15 p.m., and midnight respectively. There was little further change apparent in the appearance of the young colony until 1.30 a.m., at which time inversion began.

On completion of cell-division the whole mass of cells measured  $40 \times 44 \mu$ , the vesicle  $48 \mu$ ; since zoospores measure  $36 \times 46 \mu$  there is very little increase in size.

(b) *Inversion*.—The pause, lasting perhaps one to three hours, which succeeds completion of cell-division is no doubt the period of preparation for inversion, but the small dark-brown body was too dense for much detail to be visible (Plate XLVII, A), so that inversion had to be studied from the outside appearance only. During the quiescent period the somewhat kidney-shaped colony contracted slightly; after some time it was seen to undergo a kind of spasm inside the vesicle, during which a shallow depression appeared near the phialoporic end (fig. 10, A, 1.20 a.m.). In five minutes it had recovered and resumed its former shape.

Very soon one end was seen to be slowly protruding, and in this a lighter cross-shaped area began to appear—the phialopore was opening with four distinct lobes (fig. 10, B, C; Plate XLVII, B, 2.35 a.m.). These four lobes opened out widely (Plate XLVII, C, 2.45 a.m.) and began to turn back (D, 2.49 a.m.), much as in the male globoid, and clearly defined “hat” stages quickly followed—the brim turned back over the crown (E, 3.0 a.m.), the crown rounded out, and inversion was complete (F, 3.4 a.m.). Almost immediately (3.6 a.m.) the movement of the very short cilia could be detected, and by 3.17 a.m. the cilia had already lengthened considerably and the colony, after a little preliminary oscillating, was rotating slowly within the

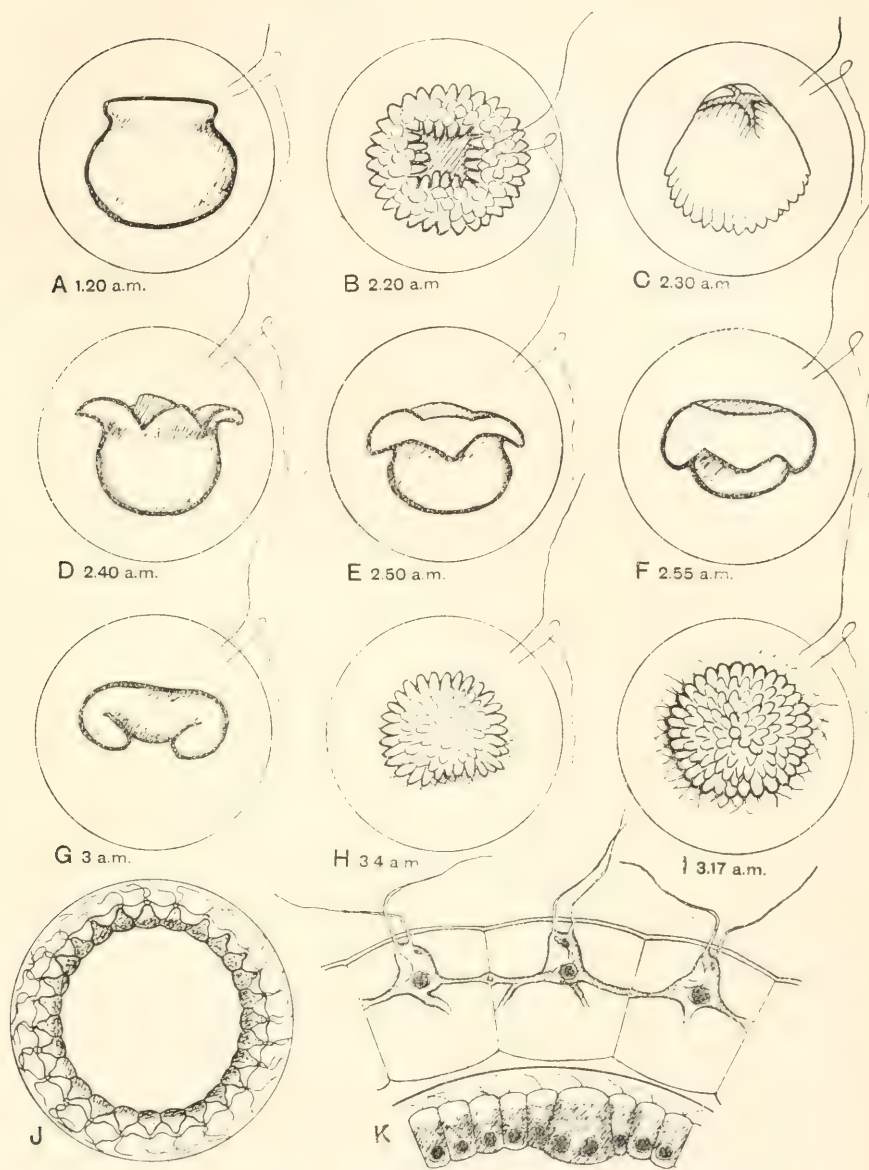


FIG. 10.—*V. Rousseletii*. Development of the germ colony (continued).

A–I, The same colony as in fig. 9; A, preparation for inversion; B–H, inversion; I, fully formed germ colony, rotating within vesicle, cilia lengthening; J, optical section of an older germ colony still enclosed in the vesicle; K (from a photograph), small portion of a fully developed Juvenile showing three cells from the equatorial region and part of the developing daughter colony, already inverted, with a gonidium.

A–I  $\times$  about 500; J  $\times$  about 600; K  $\times$  875.



vesicle. The diagrams A to I in fig. 10, from drawings made at the times stated, show the successive stages more fully than the incomplete photographic record.

The method of inversion is very like that found in the male globoid, but the four lobes to the phialopore are far more distinct, and the whole process more rapid. Judging from the inversion figures of daughter colonies seen in *V. gigas*, inversion of the germ colony is even more like inversion in the latter than in the sperm globoid, but living material of that species has not as yet been examined (Pocock, p. 485).

In another case observation started with the 2-celled stage half an hour after noon. By 8 p.m. the 128-celled stage had been reached, after which again observation was unfortunately interrupted by the loss of the object in question.

The need for speed in development is obvious. Except for its power of movement in the earlier stages of development and the possession of the delicate vesicle membrane, the zoospore and its product are entirely unprotected and very liable to destruction. Of necessity the cases quoted were under constant and very strong light, and it is impossible to say what effect, if any, this would have on the rate of division. It might quite conceivably exercise a retarding influence. A series of experiments on the effect, if any, which light intensity or continuity has on the development of the zoospore would be most interesting.

The difficulty of getting good accurate drawings is extreme, while photography from the life is next to impossible—to begin with, apart from its small size the colour is so dark that, in addition to high magnification, long exposure is necessary to obtain detail; the earlier stages are motile, and later the tiny object is rolled here and there by the slightest current in the water or the movement of any of the numerous motile unicellular plants or animals found with it—in this case, for instance, a very small and active chlamydomonas was most trying. Finally, as soon as inversion is complete movement within the vesicle begins.

#### *Appearance of the Young Colony after Inversion.*

On completion of inversion the young colony is somewhat reniform in shape (Plate XLVII, G), soon becoming more or less spheroidal. Immediately after inversion it measured  $40\ \mu$  in diameter,  $44\ \mu$  before, in a vesicle of diameter  $55\ \mu$ .

Another, slightly older, measured  $40 \times 44\ \mu$  in a vesicle  $58 \times 60\ \mu$ . The cells are deep brown in colour and closely packed, and the cilia



short. The whole appearance except for the colour is very like that of a sperm globoid at the same stage, but the common wall soon becomes clearly apparent outside the whole colony (Plate XLVII, L). Enlargement, still within the vesicle, follows; the protoplasts increase in size and become more distant, and the cilia lengthen till the whole vesicle is filled (fig. 10, J).

The vesicle finally disappears. The young colony was never actually seen escaping, and there is some evidence that the vesicle wall disintegrates—in one case, while the vesicle was intact in parts, in others the cilia were protruding through it; possibly here, too, there is enzyme action on the part of the young colony, or possibly the action of the latter in its now fairly active movement is sufficient to destroy the aged and much-stretched vesicle wall. Colonies as large as  $53\ \mu$  and  $66\ \mu$  were seen still within vesicles which measured  $62\ \mu$  and  $75\ \mu$  respectively. In the first of these the cilia were sweeping the inside of the vesicle and some protruding from it where the wall had been destroyed.

Meanwhile the colour of the protoplasts has been growing lighter. The haematochrome is gradually replaced by chlorophyll, remaining here and there as red globules, sometimes collected near the centre, sometimes near the apex of the cells, and finally disappearing entirely except in the large eyespots, which now for the first time become visible in the anterior cells (Plate XLVIII, B, C).

This colour-change begins while the colony is still enclosed in the vesicle, but is not completed until after it has been moving freely for some time. With the differentiation of the eyespots the colony first becomes phototactic.

## II. THE JUVENILE FORM.

The young colony is now growing into the very characteristic Juvenile form, a small structure sharply distinguished from the Adult form—the typical *Volvox* colony—by its much smaller size and few, considerably larger, cells.

The vegetative cells are essentially similar in structure to those of the adult, but the protoplasts are larger and more widely spaced with very strong thick connecting strands, the two cilia are inserted wide apart, and the limiting membranes are very distinct (fig. 10, K). The inner and outer wall of each cell forms a well-marked curve, so that both inner and outer membranes, instead of appearing each as a more or less continuous curve, are built up of a series of separate

curves, this structure being more marked than in any adult form. Among the vegetative cells are found a varying number of reproductive cells, gonidia, distinguished by their greater size, richer cell contents with several pyrenoids, and greater number of connecting strands (Plate XLIX, B).

This description of the Juvenile form, as of the second generation which follows, holds equally for *V. Rousseletii* and *V. capensis*. In the latter, however, no stages in germination between the first (escape of spore from the episore) and free-swimming Juveniles have as yet been seen.

In the collections of Juveniles from the Cape Flats (Plates XLVIII, E, F; XLIX, A) there has been remarkable uniformity of shape, size, and number of component cells. The same holds for the rich collection of Juveniles of *V. Rousseletii* from Kimberley. In the cultures of *V. Rousseletii* oospores from the Rietfontein material, however, the Juveniles showed much more variation in the form and size of the young colonies, and also in the number of component cells—some with as few as 60 cells and others with as many as 375 occurred, although the majority had in the neighbourhood of 240. This variability is probably attributable to the artificial conditions of the cultures. It is well illustrated by the series of photographs of Juveniles from the oospore cultures (Plates XLVII, H–L; XLVIII, A–D).

#### *Development of the Second Generation.*

At a very early stage in the life of the Juvenile, before it has escaped from the vesicle, some larger cells can be distinguished in the posterior half (*cf.* Henneguy, 1879, p. 94, in the case of *V. aureus*). These are the gonidia, probably usually four in number, although as many as five developing daughters have been seen. Usually of these only one or two (Plate XLVIII, D), more rarely three (Plate XLVIII, A, B), develop. In the first collection of Juveniles from Keurboom Road one was the usual number, two the exception. Later in the year, in the very vigorous Dabchick Vlei collection, more Juveniles contained two than one, while in the Kimberley material nearly 25 per cent. contained three young daughters, while in one Juvenile as many as five were seen. In the latter material, too, the Juveniles were unusually large—several about  $322 \times 345 \mu$  with rotating daughter colonies up to  $194 \times 215 \mu$  were seen, while one of  $322 \times 366 \mu$  had a single mature daughter of  $215 \times 240 \mu$ .

These daughter colonies of the second generation develop and escape

from the Juvenile parent quite normally (Plate XLIX, A, C, D), but are always fewer and larger celled, and on the average considerably smaller than typical adults (Plate XLIX, E). They undoubtedly constitute a transitional stage, and are fairly easily distinguished from the true adult which appears in the next generation, *i.e.* in their grown-up daughters. In the oospore cultures colonies of the second generation containing from four up to ten daughter colonies were obtained; in the majority of cases, however, both from cultures (Plate XLIX, E) and in the field the number of gonidia which develop in the second generation is comparatively small—in the photograph, in addition to the four developing daughters, two abortive gonidia can be seen. This photograph also shows very well the coarse appearance of the cell network due to the large size of the cells; the difference in texture between the second and subsequent generations is indicated in the group from the Flats (Plate XLIX, A); on examination of the colonies included in it, it can be seen that the lower one on the right, in proportion to its size, is composed of fewer and considerably larger cells than the large upper colony on the left. While the cells in the anterior part of the colony are more widely spaced than the posterior (Plate XLIX, F, G), the difference is on the whole less marked than in typical adult colonies, the cells in both regions being markedly larger than those in corresponding regions of the latter. These photographs should be compared with the similar ones from a normal colony of *V. Rousseletii* already figured (Plate XIV, B and C, D and E); the colony from which they were taken was rather younger than that shown in the adjacent photograph.

So far as has been observed, the colonies of the second generation are invariably asexual; sexual cells are not differentiated until some generations later.

With the second-generation colonies the life-cycle is complete.

#### *Previous Accounts of Germination in Volvox.*

Accounts of germination of the oospore in *Volvox* founded on actual observations are meagre in the extreme, and such as there are refer exclusively to *V. aureus*.

The only reference found to germination in *V. globator* is contained in a brief note describing a "growing slide" devised by the Rev. A. Pagan (1887, p. 81), where it is stated that he observed "the growth of spores of *Volvox globator* after they had been confined to the slide for six weeks, the actual process of germination taking

three days to complete." No further description or drawings are given.

In *V. aureus*, Cienkowski (1870) observed germinating oospores as far as the second division and believed that each sphere of segmentation eventually became a coenobium.

Henneguy (1879, p. 93) germinated spores from material collected in a deep basin in the Jardin des Plantes, and describes stages in development briefly but clearly; he observed the escape of the spore from the hard exospore, projection of the swollen endospore, division of the spore contents into 2 equal parts, which by successive bipartitions give rise to 4, 8, 16, etc., small cells, thus forming a "blastoderm analogous to the blastoderm of a holoblastic ovum." Inversion was not noticed, but the formation of the cilia within the endospore, subsequent disappearance of the latter, and development of the young colony are mentioned. No reference is made to any difference between the latter and the ordinary adult colony. Kirchner (1879, p. 99) also published an account of germination in *V. aureus* with figures, and on his paper most of the accounts included in descriptions of the genus are based, e.g. by Pascher (1927, pp. 66, 462), Oltmanns (I, p. 230, figs. 6, 7, 236), Printz (1925, p. 3, fig. 21). Unfortunately Kirchner's paper has not been available in this country for reference, but from the details given by the authors quoted above he adds little or nothing, apart from the diagrams, to the details given by Henneguy. Nowhere is any reference made to the intervention of a "Juvenile" form, and each writer expressly states that no motile zoospore is formed.

Zimmermann (1921, p. 274) refers to Kirchner for the external course of development, and confines himself to the cytological aspect, finding that the first division is heterotypic and is followed by successive divisions of the usual type. Thus he too agrees that in *V. aureus* no motile zoospore is formed, and that all four cells resulting from reduction division combine to form the single young colony.

Mainx (1929, p. 211) found that in *V. aureus* in certain conditions oospheres ripened parthenogenetically into oospore-like structures, and that these parthenospores germinated exactly as described by Henneguy, Kirchner, and Zimmermann for the zygote. At the same time Zimmermann's observation of reduction division goes to show that some at least of the resting spores are true zygotes.

Previous accounts of germination in *Volvox*, therefore, are all based on only two or three observations of *V. aureus* and can be taken only as referring to that species, not to the genus as a whole.

Thus the above account of germination in *V. Rousseletii* fills a



gap in the existing knowledge of the life-history of the *globator* section of the genus (*Eu-Volvox*), and is of particular interest in that it is the first record of the formation of a motile zoospore within the genus. A brief summary of the results of the oospore cultures are given in an appendix.

#### DISCUSSION.

1. *Germination of the Oospore*.—From the summary of accounts of germination in *V. aureus* given above, it would appear either that the process there is very different from that in *V. Rousseletii* (which is probably common to the whole *Eu-Volvox* section), or possibly that some confusion has arisen consequent on the formation in that species of parthenospores. Perhaps the accounts, few in number, which exist describing germination in *V. aureus*, do not tell the whole story.

While it is obviously dangerous to generalise for a large group such as *Volvox* from observations made in the case of only one or two members thereof, yet *V. Rousseletii* is obviously so closely allied to *V. capensis*, *V. globator*, *V. perglobator*, and other species described from America, that the expectation of similar phenomena in those species is certainly justified. It remains for further research to show whether this expectation is confirmed by the facts.

As regards the other members of the group, of which only *V. aureus* has so far been investigated and that not recently, with respect to the external course at any rate, it is possible that their behaviour during germination is different. Since, however, there are many indications that the members of the *Eu-Volvox* section are the most highly organised of the group, one would expect that if zoospore formation is found in the highest members it would occur also in the relatively simple members. If the difference does actually exist, it is an additional argument for dividing the genus *Volvox* into subgenera.

It is very important to find whether reduction division invariably precedes zoospore formation. If the supposed oospore is in truth a zygote—the result of fertilisation—then reduction division is obviously a necessity. The same applies in the possible case of a nuclear fusion other than true fertilisation. Although this is unlikely, yet the finding of multinucleate oospheres makes it a possibility to be considered.

The experience Mainx had of development of parthenospores in *V. aureus* indicates the possibility of some at least of the apparent oospores being actually parthenospores. If this is so they may be



expected to behave differently during germination, and it seems within the bounds of possibility that the early descriptions of germination in *V. aureus* really apply not to oospores but to parthenospores.

The present investigation has not been decisive as regards the number of zoospores formed, nor has it dealt with reduction division. Further, except in one case, and that a doubtful one, no sign of vestigial zoospores has been seen within the vesicle containing the single large zoospore. Occasionally there have been seen zoospores containing more than one (up to four) nuclei, and it is possible, though not probable, that three of the nuclei resulting from reduction division may degenerate without any corresponding division of the cytoplasm occurring.

To sum up, then, the present investigation leaves several very important problems for future research :—

(1) Does reduction division take place as supposed during the period of enlargement of the spore subsequent to escape from the spiny episporium ?

(2) Does reduction division always occur in the germination of the apparent oospore, or only in certain cases ?

(3) If the latter is true, are some of the resting spores really parthenospores ?

(4) When a single zoospore is formed, is it a result of reduction division or not ? If not, then it is presumably formed from a parthenospore.

(5) If the single zoospore results from reduction division, do the remaining three nuclei degenerate without corresponding division of the cytoplasm, or are vestigial zoospores formed within the endospore ?

A few details, notably the mode of formation of the endospore protuberance, the actual escape of the zoospore, and the escape of the Juvenile from its surrounding vesicle, in addition to the all-important act of fertilisation, still remain to be observed.

2. *Form of the Colony resulting from Germination.*—No distinctive Juvenile form has ever been recorded for *Volvox*, yet in both *V. Rousselletii* and *V. capensis* the Juvenile is so remarkable that it might easily be mistaken for a distinct species. Probably it is only in those forms of *Volvox* where the number of cells is exceedingly large that such a transitional form is produced, while in the other sections of *Volvox*, all of which have comparatively few cells (1000 to 4000), the difference between the first-formed colony and later generations is so slight that it hardly constitutes a distinct form. In *V. globator*

and its near allies, however, it seems probable that a similar Juvenile is formed, although it has not hitherto been described.

3. *The Process of Inversion*.—The present investigation shows, in *V. Rousseletii* and *V. capensis* at any rate, that wherever a single reproductive cell divides to form a new spheroid, whatever its nature, the type of cell-division is such that on completion of cell-division re-orientation of the cells by means of inversion of the whole spheroid must inevitably follow; this is without doubt true throughout the group.

The point needs emphasising, since recent workers, while agreeing with the descriptions of inversion in the case of the daughter colonies, have either doubted its occurrence elsewhere (for example, Kuschakewitsch in the case of the colony formed from the oospore), or denied its existence (as, for instance, Pascher (1927, p. 461) in the case of the sperm globoid), while in neither case has the process been previously described or figured.

The fact that inversion in the germ colony and the sperm globoid is of a similar type to that found in the daughter colonies of *V. tertius* and *V. gigas*, while that found in the asexual daughter colony is of the type already described for *V. globator*, and that the inversion of the daughter colonies of *V. aureus* is of an intermediate type, indicates a further affinity between these species, but also indicates that the differences seen in the process are directly connected with the number of cells composing the spheroid in question.

It would appear that as the number of cells increases the comparatively simple type of inversion found in young germ colonies, in sperm globoids, and in asexual daughters of *V. gigas*, *V. tertius*, etc., becomes unsuitable, and is replaced by the progressively more elaborate types of inversion found in *V. aureus*, *V. africanus*, and finally in *V. globator* and its allies, the latter being an adaptation to the much larger number of cells composing the daughter colony in those species.

4. *Variation in the Number and Form of Vegetative Cells*.—The study of these two African species throughout the life-cycle shows that the number of constituent cells, their size, and form may all vary enormously in one and the same species in a single season. These features, therefore, cannot be taken *by themselves* as criteria for establishing new species. The same applies to the protoplasmic connections. Allowance must be made for the great plasticity of the *Volvox* cell. At the same time in classification these details must be considered in conjunction with the nature and distribution of the

reproductive cells, particularly the ripe oospores, always allowing a very wide margin within which variation may take place.

5. *Systematic Aspect*.—At present our knowledge of the behaviour of the different forms of *Volvox* under varying conditions is still so scanty that the existing classification can only be regarded as provisional. Continuous observation in the field and repeated breeding experiment as far as possible under natural conditions are badly needed.

Lacking a comparative study of the various forms in the living state it seems best to accept existing species as described and to create new species for new forms as they are discovered, particularly if found in a different part of the world, giving at the same time as fully illustrated and detailed a description as possible.

But it is very difficult, if not impossible, to draw hard and fast lines between closely allied "species." *V. Rousseletii* and *V. capensis* provide a case in point. Both, particularly the former, are widespread in Africa, and seem consistently distinct. Further, when observed over long periods, as has been done for both species—*V. capensis* in its natural habitat of the Flats and *V. Rousseletii* in Mr. Steer's Rietfontein cultures—though very variable, they are found to vary about a type which is distinct for the two. Yet the differences are largely differences of degree, and when *V. capensis* is found in warmer regions side by side with *V. Rousseletii* it undoubtedly approaches the latter more nearly, though still distinct. Therefore, they must, for the present at any rate, be regarded as distinct species.

Again, on the one hand, *V. capensis* approaches very closely to *V. globator*, while on the other *V. Rousseletii* seems almost identical with Powers' (1908, p. 162) species *V. perglobator* from America, so far as one can judge in the absence of certain descriptive details and figures of the latter species.

As regards the two former, whereas typical *V. capensis* is very distinct from typical *V. globator*, yet the cold weather form of the former approaches so much nearer to *V. globator* as to suggest the possibility of the two being merely regional forms of the same species. But without the necessary experimental evidence, or a detailed study in the field of both members of the allied pairs, it is better at present, for the sake of clearness if for no other reason, to retain the separate specific rank. Possibly later, when the group is re-studied as a whole and our knowledge of the various species has been extended by experiment and study of living forms, some of the existing species

may be sunk as regional forms or even as phases in the life-cycle of other pre-existing species.

Most emphatically study of preserved material of one or two small collectings and those incomplete as regards the various reproductive cells, without corroborative studies of living material, is in general insufficient for creating new species; existing descriptions based on such material are, as a rule, extraordinarily lacking in important details.

#### SUMMARY.

Two species of *Volvox*, *V. Rousseletii* G. S. West and *V. capensis* Rich and Pocock, have been studied in the life, living as far as possible under natural conditions, the former in tub and pond cultures at Sea Point, the latter in its natural habitat on the Cape Flats. Both are very closely allied to *V. globator* as regards cell-structure and life-history.

The *vegetative cells* are normally far more numerous than in that species, are similar in structure, but differ in the shape of the chloroplast from the descriptions given of *V. globator*. Throughout the life-cycle of a given strain there is great variation in both the number and the form of the constituent cells.

*Asexual reproduction* follows the same general lines as in *V. globator*. The changes preparatory to inversion are described for the first time. Inversion of the daughter colony is similar to the description of the process in that species, but the connections between daughter and parent are attached in a ring some distance from the edge of the phialopore and not to the cells immediately round it. The phialopore closes completely after inversion. The inverted daughter develops within the much enlarged gonidium vesicle, never free within the hollow of the parent. When mature, each daughter escapes outwards, forming its own pore of escape. Liberation inwards was only once observed and was probably pathological.

*Sexual Reproduction*.—*V. capensis* is monoecious, *V. Rousseletii* dioecious. In the former the colony produces 4 to 22 sperm globoids and 60 to 150 oospores, and is strongly protandrous. In the latter the male colony produces from 100 to several hundred sperm bundles, the female 150 to 200 or more oospores.

The male initial cell in *V. Rousseletii* in general shows a shifting of the polar axis of the cell before division, the phialopore of the sperm globoid being consequently directed sideways or inwards during development. In *V. capensis* there is no such shifting of the



physiological axis of the initial cell, and the phialopore is consequently directed outwards. Otherwise division is similar in the two, the same number of cells (512) being formed. Completion of cell-division is followed by inversion, similar to the type found in asexual daughters of *V. gigas*. Preparation and inversion are described and figured fully for *V. Rousseletii*, are similar in *V. capensis*, but differ in some details.

The oosphere is similar in the two species; in *V. Rousseletii* it usually has a more marked neck than in *V. capensis*. At first the apex of the oosphere is near the surface, after fertilisation it rounds off and is sunk deep in the parent. As in the daughter colony both sperm globoid and oospore are enclosed in a vesicle which remains intact throughout development.

The mature sperm bundle escapes outwards, the sperms escape from the enveloping wall and may be seen swimming in the water. The sperm is elongated, similar to those of *V. globator*, but with cilia which, though directed backward, are actually inserted at the apex.

*Fertilisation* was not observed, but in both species sperms were repeatedly seen inside colonies with young oospheres.

The *oospore* in both has an outer covering of strong conical spines, longer in *V. Rousseletii*, while in *V. capensis* the spore without the spines is slightly larger.

The *germination* of the oospore results in the formation of a large motile *zoospore*, possibly in some cases 4 zoospores, thus differing from all previous accounts of germination in *Volvox* which, however, are only of *V. aureus*. Germination is described in detail as far as regards external appearance.

The *zoospore* divides, continuing motile up to the 3rd or 5th division. After from 7 to 9 divisions a short period of preparation follows, after which the young colony inverts similarly to the male bundle, has cilia, and rotates within the vesicle. It eventually escapes and develops into the characteristic Juvenile form.

The *Juvenile form* produced when oospores germinate was first collected on the Cape Flats, later raised from oospore cultures. It is few and large celled, and very distinct from the Adult form. It produces 1 to 3, very rarely more, up to 5, daughter colonies.

The *second-generation* colonies are very like the Adult, but composed of fewer and larger cells. Their daughters have the full complement of cells.

*Inversion* is an inevitable consequence of the type of cell-division



in the group, wherever a single reproductive cell divides to form a spherical bundle of cells. In every case the cilia are formed during, and not subsequent to, the process of inversion. The emission of the cilia plays an important part in bringing about inversion.

The changes brought about by varying conditions and ageing of the strain are indicated, and the great variability of the members of the group illustrated by the behaviour of the two species.

The existing classification of the group can only be regarded as provisional, but before a detailed revision can be attempted extensive observations of and experiments with *living* material of the various species are necessary.

The above in the main formed the subject of a thesis submitted in March 1932 for the degree of Ph.D. of the University of Cape Town. The thanks of the author are due to Mr. E. J. Steer, not only for an unfailing supply of material, but also for the use of certain pieces of apparatus, to Professor Fritsch and Miss F. Rich of the East London College, University of London, and to various members of this university:—to the Librarian and staff of the Jagger Memorial Library for facilities accorded while consulting various works bearing on the subject, to Miss E. L. Stephens for the use of her collection of Algal literature, to Mrs. Levyns and to Professor Adamson, Harry Bolus Professor of Botany, for much helpful criticism and encouragement during the course of the investigation.

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## APPENDIX.

OOSPORE CULTURES, *V. Rousseletii*.

Very rich sexual material containing many colonies red with ripening oospores was obtained from one of Mr. Steer's tubs early in February 1931. Some of this was put in an old battery jar half full of water, and placed in a south window. The female colonies disintegrated, and the oospores and detritus collected at the bottom of the jar as a red-brown sediment, most of the detritus eventually being destroyed by the animal organisms present.

Some of this oospore material was left in the jar, some was placed on slides and allowed to dry.

*Culture I.*

5th July.—Material from the stock jar, containing unaltered oospores and spores escaped from their exospores, was transferred to a small vessel to which strained water from the Wetton Road vlei was added. It was placed on soil in a basin of water and put where it would get the morning sun.

6th July, 6 p.m.—Examined; many oospores with exospore cracked and spores escaping, and golden-brown spores already free from exospore.

7.45 p.m.—Examination continued. Found (1) golden-brown germ colony,  $40 \times 44 \mu$ , moving inside a delicate vesicle  $58 \times 60 \mu$ , (2) spore with endospore protruding and contents partly in it, mesospore still enclosed in spiny exospore (see Plate XLVI, H).

9.20 p.m.—Germ colony still dark brown, but clearer; cilia much longer, very active. A second colony, recently inverted, with very short cilia.

7th July.—Again put in sun during morning. *Paramoecium* eating many of the smooth-walled spores which had escaped from the spiny outer coat.

9th July.—Two more germ colonies seen rotating in vesicle; this time, attached to the vesicle-wall, two long, motionless cilia were clearly visible. Count of cells round the edge 34, 36, giving a cell number of 395 to 471, i.e. intermediate between 2<sup>8</sup> and 2<sup>9</sup> (Plate XLVII, G).

*Culture II.*

Oospore material from stock jar transferred to a small dish and allowed to dry out completely.

3rd August (Monday).—Water added as soon as dry, placed in sun as in first culture. Wednesday to Friday, wet and overcast; Saturday afternoon and Sunday, warm and sunny.

9th August (Sunday).—Many small Juveniles present, ranging in size from  $53 \times 53 \mu$  in vesicle  $66 \mu$  and  $44 \times 66 \mu$  (free) to  $80 \times 80 \mu$ , very active, gonidia 1 to 4.

- 11th August.—Juvenile  $120 \times 133 \mu$ , gonidia dividing; in structure and appearance exactly similar to those found on the Cape Flats.
- 13th August.—Mature Juvenile with daughter about to invert.
- 15th August, 6.30 p.m.—Germ colony in 4-celled stage found, moving actively. Watched through completion of cell-division and inversion until 3.17 a.m., when the colony was beginning to rotate within the vesicle, after which the colony was lost. This developing colony continued motile until after the fifth cell-division; before the 64-celled stage the zoospore cilia ceased to function (figs. 9, G-L, and 10, A-I; Plate XLVII, A-F).
- 28th August.—Many Juveniles, up to  $199 \times 208 \mu$ , and second generation colonies up to  $667 \times 689 \mu$  with from 4 to 10 daughters.

### *Culture III.*

- 17th February.—Oospore material from stock jar put on slides and left to dry; put on one side for later use.
- 24th July.—Slides placed in dish in water, and the whole placed as in Culture I.
- 7th August.—Strained vlei water with a small quantity of Uspenski's culture solution added.
- 21st August.—Slide lifted out of dish and examined. (1) Many oospores in various stages of germination. (2) Zoospore escaping from mesospore into protruding endospore (Plate XLVI, G). (3) Zoospores moving about on slide (Plate XLVI, I, J). (4) Zoospores in various stages of division—2-, 4-, 8-, 16-celled, etc.
- 22nd August.—More of the above, and in addition a mature Juvenile with nearly mature daughter.
- 23rd August, 12.30 p.m.—Two-celled stage found and watched through stages of division up to 128-celled stage at 8 p.m. Movement here ceased after the 4-celled stage, before the third division.
- Many Juveniles of all sizes, some just changing colour—green with a few globules of the red pigment.
- Colonies of the second generation up to  $244 \times 267 \mu$  with from 5 to 9 gonidia mostly in early stages of division.
- 31st August.—Zoospores in various stages of cell-division.

*N.B.*—Whereas most second generation colonies were obtained from Culture II, the method used in Culture III, *i.e.* letting oospore material dry on a slide and later emerging it in water or other culture medium, is undoubtedly far the best for observation of the zoospore and its development. Of other cultures, those not in the sun did not go beyond the first stage in germination—a few spores escaped from the spiny exospore, but most showed no sign of germination. If the culture solution (Uspenski's) was used full strength, the Juvenile colonies which developed showed abnormalities, the cells tending to separate from one another.



*Note.—Volvox from Grahamstown.*

In the paper entitled "Observations on the Genus *Volvox* in Africa (Rich and Pocock, 1933, p. 460) a form of *Volvox* is recorded from Grahamstown. The material was nearly all asexual and in the absence of mature sexual colonies was provisionally included under *Volvox Rousseletii* West.

Quite recently a further supply has been sent by Miss Britten (Britten, 4170, 4173, 12th–14th March 1933). This includes a small number of sexual colonies in various stages of development.

The oospores are still green even in the oldest colonies, but are quite clearly of the *V. capensis* type, the spines being broader and shorter than in *V. Rousseletii*.

*Male reproductive bodies* are unfortunately scarce, but there are no separate male colonies and the few mature sperm-globoids seen are all in young monoecious colonies associated with numerous very young oospheres, *i.e.* this *Volvox* is a monoecious species with oospores similar to those of the Cape Flats form.

It must therefore be diagnosed as *Volvox capensis* and not as *V. Rousseletii* as previously thought.

Its occurrence is curious—so far, in the Grahamstown district it has been found in one locality only, a rocky pool in quartzite formation at the foot of a small cliff in the woods near the Mountain Drive. It appears to be somewhat capricious in its periodic appearances, and when seen by the writer has always been somewhat unhealthy looking, although fairly large. The first collection was rather badly attacked by Rotifers, the second by an amoeboid parasite. This may perhaps be connected with the fact that the pool in which it occurs is among trees and gets little direct sunlight.

*Dimensions.*

Asexual colonies . . .	?	– 969 $\mu$	$\times$	?	– 1141 $\mu$
Daughter colonies . . .	?	– 322 $\mu$	$\times$	?	– 345 $\mu$ , up to
				8 per coenobium	
Sexual colonies . . .	?	– 1012 $\mu$	$\times$	?	– 1098 $\mu$
Oospores (immature) with					
spines . . . . .	48–	50 $\mu$			
Oospores (immature) without					
spines . . . . .	35–	38 $\mu$			
Sperm globoid . . . . .	37–	40 $\mu$			

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## DESCRIPTION OF PLATES.

The numbers in brackets are the index numbers of the negatives from which the photographs are taken.

## PLATE XXXVIII.

A-C, E-F. *V. Rousseletii*. D. *V. capensis*.

FIG.

- A. Mature female colony, mucilaginous content of central hollow discoloured (yellowish) showing inner membrane (310).  $\times 48$ .
- B, C. Mixed colonies. B, Abnormally shaped colony with 2 large daughters and a number of oospores (311).  $\times 48$ .
- C. Young colony containing 7 developing daughters, several mature sperm globoids, and numerous developing male cells in all stages (249).  $\times 65$ .
- D. *V. capensis*. Cells at anterior pole (living, unstained) focussed to show eyespots (559).  $\times 1000$ .
- E. *V. Rousseletii*. Developing daughter colony showing attachment to parent (159).  $\times 30$ .
- F. Living cells from posterior pole of young colony (94).  $\times 900$ .
- G. Part of mature asexual colony showing pore above a daughter colony (removed). Protoplasmic connections mostly not visible owing to faulty fixation. Stained Delafield's Haematoxylin to show cell walls (32).  $\times$  about 650.

## PLATE XXXIX.

A, B, and F. *V. capensis*. C-E. *V. Rousseletii*.

- A. Cell detail, equatorial plane, and portion of daughter colony shown in B, showing palisade of closely packed cells. Living (560).  $\times 1000$ .
- B. Young daughter colony, living, *in situ*; recently inverted, showing gonidia and part of the periphery of the parent (561).  $\times 465$ .
- C. Escape of daughter colony. One in the act of escaping, pore left by another showing as a flattening on the right (24).  $\times 45$ .
- D. Escape of daughter colonies; group including the above with daughter now free, one with 3 daughters showing position whence fourth has escaped, and a third with all the daughters gone (25).  $\times 16$ .
- E. Portions of a female colony with 1 developing and 3 or 4 mature oospheres on left; on right part of a male colony with 2 undivided male initial cells (side and surface view) and a mature sperm globoid. Living (198).  $\times 500$ .
- F. *V. capensis*. Part of a colony showing ripening oospores, 2 with thick, smooth walls; the rest normal, covered with stout conical spines (553).  $\times 290$ .

## PLATE XL.

Inversion of the daughter colony.

A, B. *V. capensis*. Preparation.

- A. Young daughter just prior to completion of cell-division, showing phialopore (153).  $\times 290$ .
- B. Colony with 8 daughters, living, showing denting preparatory to inversion. Lip of phialopore depressed, outline definite (547).  $\times 80$ .

C-K. *V. Rousseletii*. Inversion ; living, all  $\times 200$ .

FIG.

- C, 11.10 a.m. Preparation ; colony dented, lip depressed (262).  
 D, 11.55 a.m. Denting more extensive, lip rising (263).  
 E, 12.5 p.m. Dents disappearing, lip straightening (264).  
 F, 12.10 p.m. Dents smoothed out, lip nearly straight (265).  
 G, 12.15 p.m. Beginning of inversion proper —“ Hour-glass ” stage, equatorial constriction appearing (266).  
 H, 12.17 p.m. Contraction extending over posterior hemisphere, cells sharply pointed, pore opening (267).  
 I, 12.24 p.m. Infolding beginning (268).  
 J, 12.30 p.m. Half infolded, pore enlarging, connections breaking (269).  
 K, 12.45 p.m. Connections with parent broken, colony turned over showing polar view of “ Flask ” stage with contracting pore (270).

PLATE XLI.

Inversion of daughter colony, continued.

A. *V. capensis*. Preparation.

Lower central daughter from colony above (Plate XL, B) a few minutes later—dents have disappeared, lip is still depressed, gonidia visible. Living (548).  $\times 300$ .

B-I. *V. Rousseletii*. Inversion.

- B-F. Series showing later stages in inversion. Living.  $\times 200$ .  
 B, 12.20 p.m. Infolding complete (241).  
 C, 12.22 p.m. Beginning of “ Hat ” stage, posterior part (to become anterior pole of inverted colony) beginning to emerge through pore (242).  
 D, 12.27 p.m. End of “ Hat ” stage (243).  
 E, 12.29 p.m. “ Flask ” stage (244).  
 F, 12.36 p.m. End of “ Flask ” stage, pore contracting, lip rapidly closing (245).  
 G. Another larger colony partly infolded, showing more detail—cells in anterior part stretched and pulled apart, those in posterior half compressed, sharply pointed, and very dense. Living (254).  $\times 200$ . (See text-fig. 4, A, B.)  
 H. Section through a colony in the same stage, showing “ pointing ” of posterior cells (513).  $\times 300$ .  
 I. Section of “ Flask ” stage, intermediate between E and F (530).  $\times 300$ .

PLATE XLII.

*V. Rousseletii*. Development of male initial cell (living).

- A-E. Period of enlargement : A shows 2 young ciliated male initials in different stages (213).  $\times 1000$ . B, a very young stage in surface view (250).  $\times 1300$ .  
 C, cilia lost (195).  $\times 1000$ . D, surface view showing nucleolus (335).  $\times 1000$ . E, enlargement complete (336).  $\times 1000$ .  
 F. Rotation of physiological axis—nucleolus lies inwards on left. The arrow indicates the position of the axis (186).  $\times 940$ .  
 G-N. Period of cell-division.

FIG.

- G-I. First division complete: G, axis approximately tangential to parent (188).  $\times 940$ . H, axis almost radial, connections and vesicle well defined (185).  $\times 940$ . I, axis oblique, nucleoli showing near inner end of cells, particularly in the right (189).  $\times 1000$ .
- J-N. Later stages in division: J, 4-celled (184).  $\times 720$ . K, 8-celled, showing connections and vesicle (194).  $\times 1000$ . L, optical section of "Bowl" stage (203).  $\times 750$ . M, surface view of later "Bowl" stage (180).  $\times 720$ . M, division complete, globoid in side view, phialopore on right (208).  $\times 750$ .

## PLATE XLIII.

*V. Rousselletii*. Development of sperm globoid, continued.

Series, living, showing inversion up to "Hat" stage.  $\times 750$ .

A, 8.20 p.m. Lip curving inwards (314).

B, 8.55 p.m. Lip at maximum depression (315).

C (from another series). Lip straight, pore almost closed (202). In the main series this stage was reached at 10.10 p.m., but movement spoilt the photograph.

D, 11.20 p.m. Pore beginning to open (318).

E, 11.50 p.m. Widening of pore continuing (319).

F, 12.5 a.m. "Thimble" stage, pore wide open (320).

G, 12.20 a.m. Edges of lip beginning to turn back (321).

H, 12.35 a.m. "Hat" stage beginning (322).

I, 12.45 a.m.	} Successive "Hat" stages {	(323).
J, 1.0 a.m.		(324).
K, 1.5 a.m.		(325).

## PLATE XLIV.

*V. Rousselletii*. Development of sperm globoid, continued.

Series A-C. Later stages of inversion.  $\times 750$ .

A, 12.9 a.m. "Hat" stage well developed (237).

B, 12.15 a.m. Brim curving over crown (238).

C, 12.22 a.m. Inversion complete, pore closing and movement about to begin (239).

D-F. Stages from a third series.  $\times 750$ .

D, 6.27 p.m. Preparation (373).

E, 1.30 a.m. "Hat" stage seen from above (384).

F, 2.5 a.m. Inversion nearly complete, pore still wide, line of demarcation between colourless ends and chloroplast-containing bases clearly defined.

G. Mature globoid in surface view (killed, iodine). On the left an undivided male initial cell with apex turned inward (21).  $\times 800$ .

## PLATE XLV.

*V. Rousselletii*. Escape of sperm bundles and sperms.

A. Sperm bundle about to escape; cilia bunched towards the outside, pushing through the outer wall (182).  $\times 720$ .

B. Escape further advanced; some distortion of bundle apparent (183).  $\times 720$ .

C-E. Escape of spermatozooids from globoid.



FIG.

- C. Contents of globoid loosening, cilia nearly all drawn into vesicle, a few spermatozooids nearly free (331).  $\times 750$ .
- D. Globoid from which a number of sperms, some of which are seen free, have escaped; many still moving inside. Fixed, iodine (201).  $\times 750$ .
- E. Escape nearly complete; a few sperms still active inside the wall of the globoid, which is now clearly visible. Above, part of a large mass of sperms escaped from this and other globoids (308).  $\times 750$ .
- F. Group of spermatozooids from globoid shown in D, with somatic cells (dark) torn from the parent colony. Fixed, iodine (200).  $\times 1000$ .
- G. Free sperms. Killed, osmic acid (229).  $\times 1000$ .

PLATE XLVI.

*V. Rousseletii*. The oospore and its germination.

In A, F, I, and J vesicle wall, sperms and cilia slightly emphasised; photographs otherwise untouched.

- A. Mature oosphere with sperms swarming outside the vesicle wall (429).  $\times 1000$ .
- B-D. Germination of oospore, first stage: escape from spiny exospore.  $\times 500$ .  
B, two spores, the one on the right escaping from exospore (436). C, one spore free from the exospore, which lies empty on the left. In D, exospore is split, the spore-protoplast has enlarged (430).
- E. Spore after escape from exospore; the protoplast, enclosed in the delicate endospore, lies eccentrically within the mesospore, which is stretching and becoming thinner (437).  $\times 970$ .
- F. Second stage: the spore on the right is similar to E, that on the left has enlarged considerably (431).  $\times 500$ .
- G, H. Third stage: protrusion of endospore from mesospore, and passage into it of the protoplast.  $\times 500$ . G, the spore has escaped from the exospore, and a single zoospore is being formed, clear anterior end already well defined (522). H, germination has continued within the split exospore; apparently 4 zoospores are being formed, but have not yet separated (436).
- I, 9.15 p.m. Zoospore recently escaped from endospore, cilia short, wall close to protoplast, movement hardly begun (520).  $\times 500$ .
- J, 9.55 p.m. Zoospore forty minutes later (killed, iodine), cilia lengthening, wall enlarging (521).  $\times 500$ .

PLATE XLVII.

*V. Rousseletii*. Development of germ colony from zoospore.

- A-F. Germ colony on completion of cell-division and its inversion. Living. A  $\times 310$ ; B-F  $\times 410$ .
- A, 1.0 a.m. Cell-division complete, cilia of zoospore still attached to wall of vesicle (cilia and vesicle wall slightly emphasised) (502).
- B, 2.35 a.m. Inversion beginning, four lobes of phialopore opening (506).
- C, 2.45 a.m. Lobes beginning to turn back, phialopore wide open (507).
- D, 2.49 a.m. "Hat" stage (508).
- E, 3.0 a.m. Brim turning back over crown (510).
- F, 3.4 a.m. Inversion complete, cilia lengthening.
- G. Young germ colony recently inverted, rotating inside vesicle to which zoospore cilia are still attached. Fixed, iodine (434).  $\times 970$ .

FIG.

H-J. Young germ colonies ("Juveniles") showing stages in development.

H. Still within vesicle, cells separating (478).  $\times 500$ .I. Elongated Juvenile recently escaped from vesicle; gonidia undivided (475).  $\times 410$ .J. Rounded Juvenile, about the same stage, fewer celled (476).  $\times 410$ .K. Older Juvenile, 2 daughters in early stages of cell-division (534).  $\times 240$ .L. Few-celled Juvenile, 1 developing daughter. Fixed, osmic acid (538).  $\times 260$ .

## PLATE XLVIII.

Juvenile colonies.

A-D. *V. Rousseletii*. From oospore cultures.A. Young Juvenile with 3 gonidia in early stages of cell-division. Top focus. Killed, osmic acid (483).  $\times 280$ .B. The same, median focus showing eyespot and cilia (488).  $\times 500$ .C. Typical well-developed Juvenile with a single daughter in an advanced stage of cell-division. Killed, osmic acid (540).  $\times 350$ .D. Juvenile with 2 daughters nearly ready for inversion. Killed, formalin (536).  $\times 260$ .E, F. *V. capensis*.

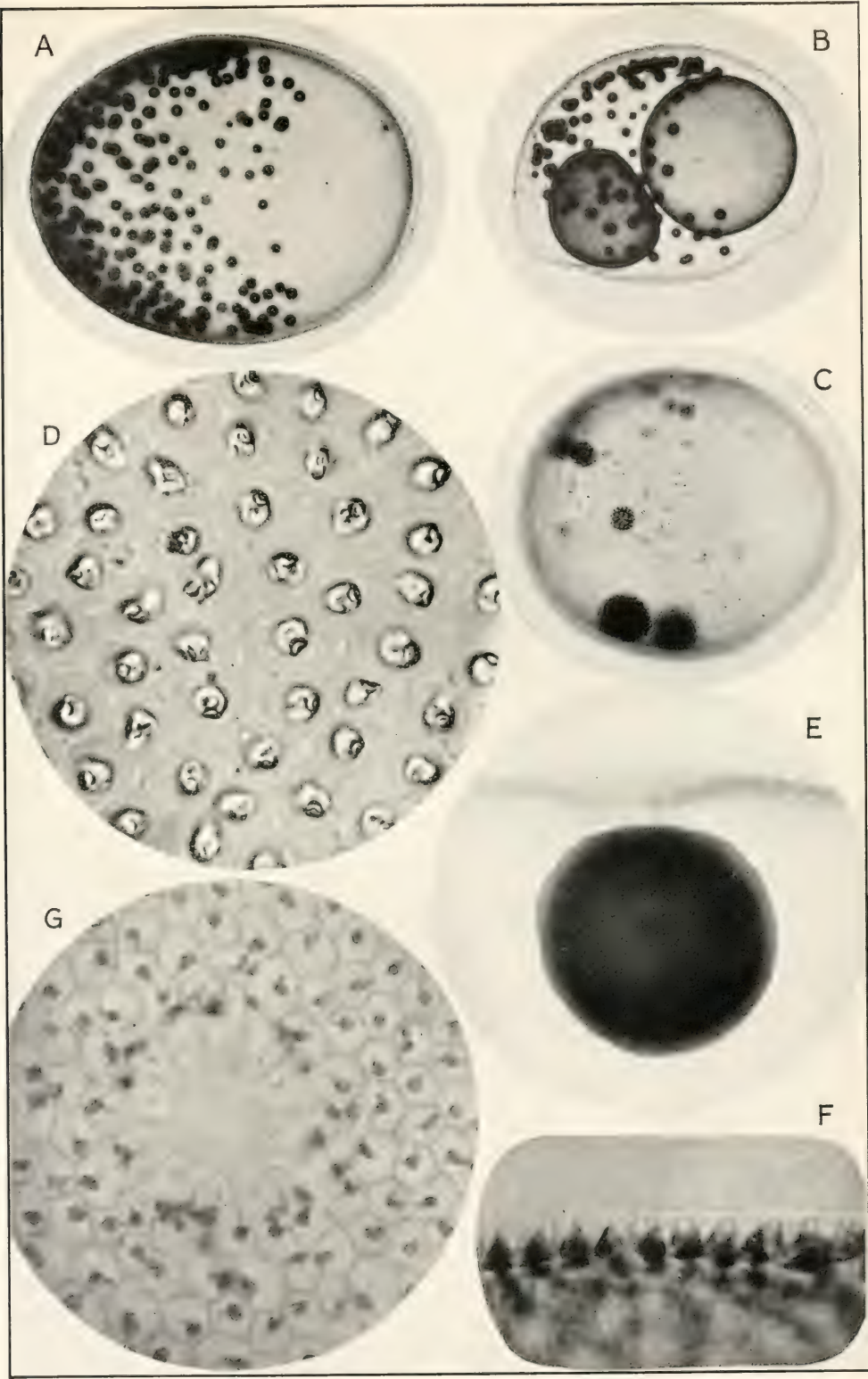
E. Juvenile, first discovered, from Ackerman's Vlei, May 1931. One mature daughter nearly ready to escape. Top focus (358).

F. The same, median focus, showing gonidia and cilia of daughter colony, vesicle wall, and inner wall of parent (360). Both  $\times 228$ .

## PLATE XLIX.

Juveniles and second generation.

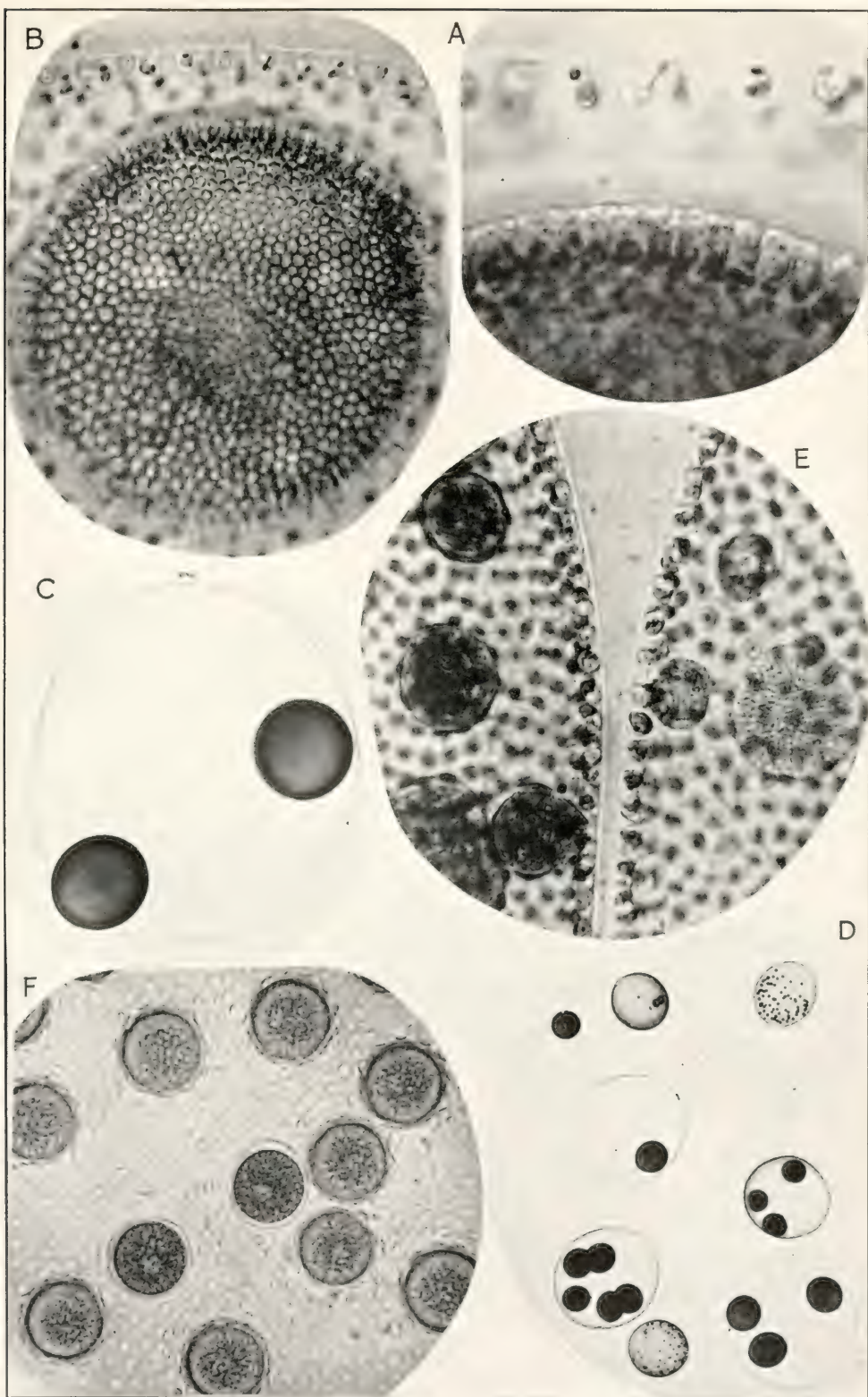
*V. capensis*.A. Group from Ackerman's Vlei, showing two Juvenile colonies each with a single nearly mature daughter (upper one showing gonidia) and colonies of the second and third generations. Killed, iodine (355).  $\times 57$ .B. Undivided gonidium from a Juvenile containing in addition 2 developing daughters (363).  $\times 1000$ .*V. Rousseletii*. From oospore cultures.C. Mature Juvenile from which daughter has escaped, showing pore of escape with torn edges (518).  $\times 170$ .D. Daughter (second generation) escaped from above (517).  $\times 310$ .E. Colony of the second generation further advanced, showing 4 developing daughters and 2 abortive gonidia (533). Compare with Pl. XIII, C; XVII, A; XX, A.  $\times 78$ .F. Cell detail, anterior region of a younger second generation colony (352).  $\times 1000$ .G. The same, from the posterior region, showing closer spacing of cells (534).  $\times 1000$ .



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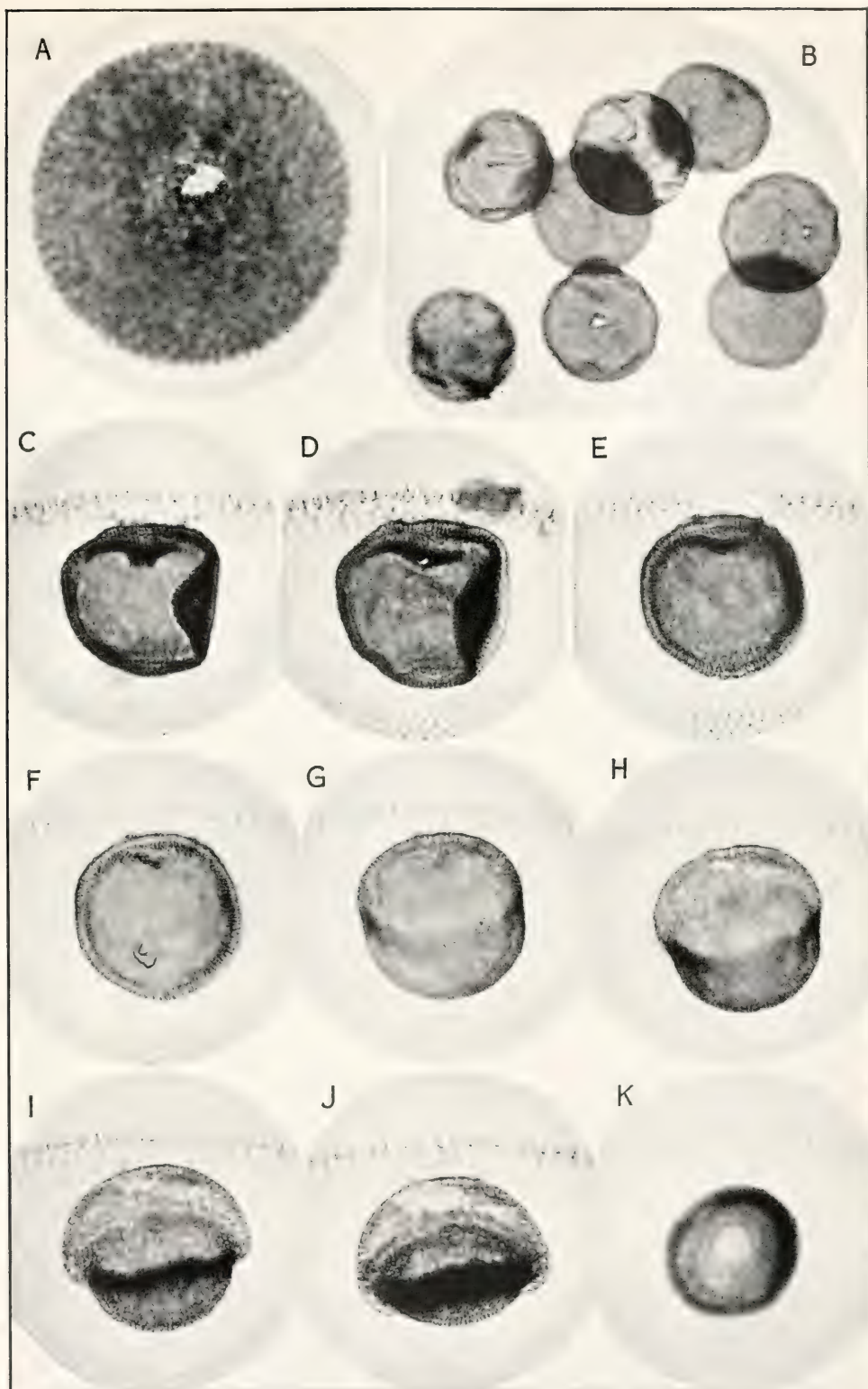




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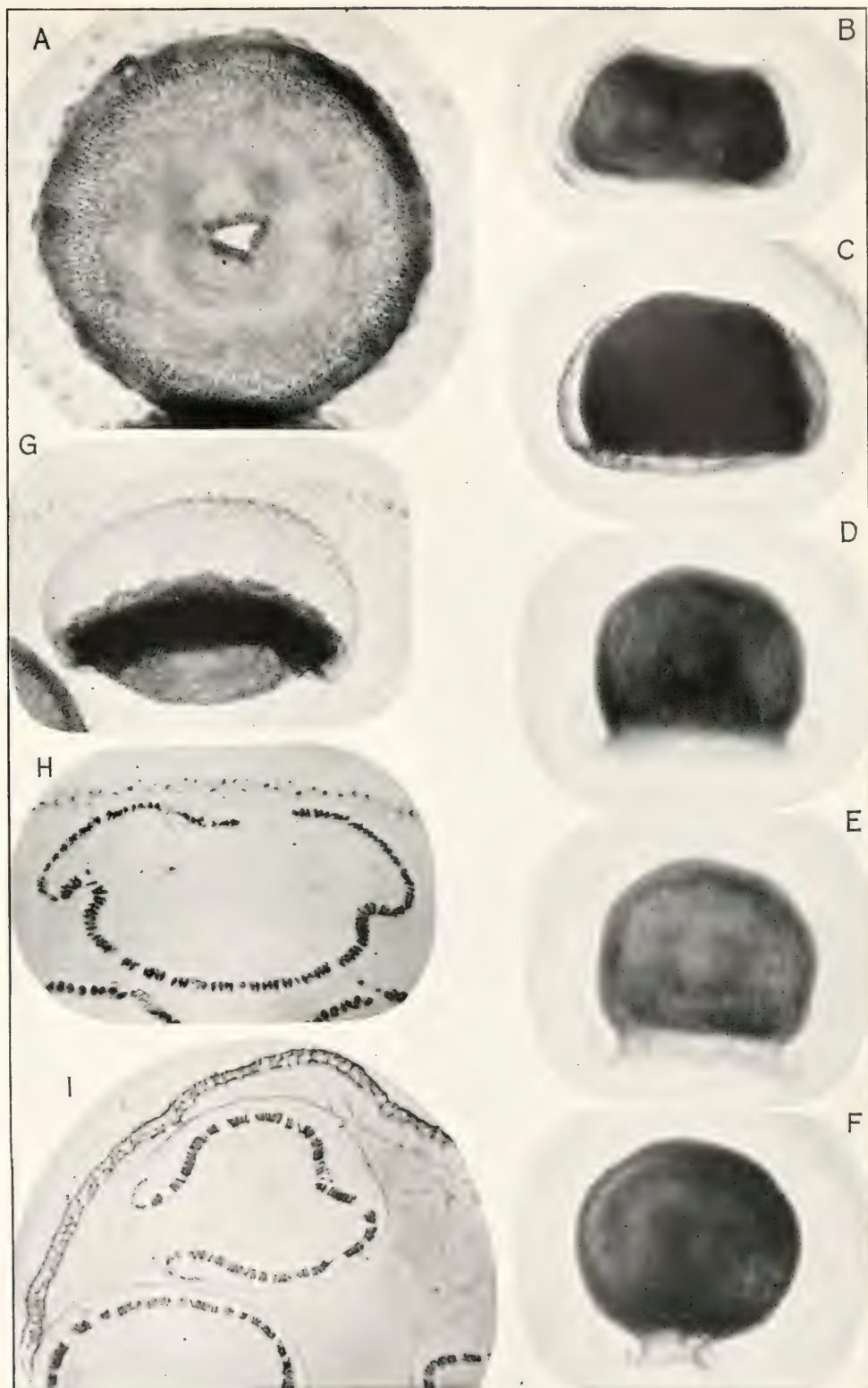






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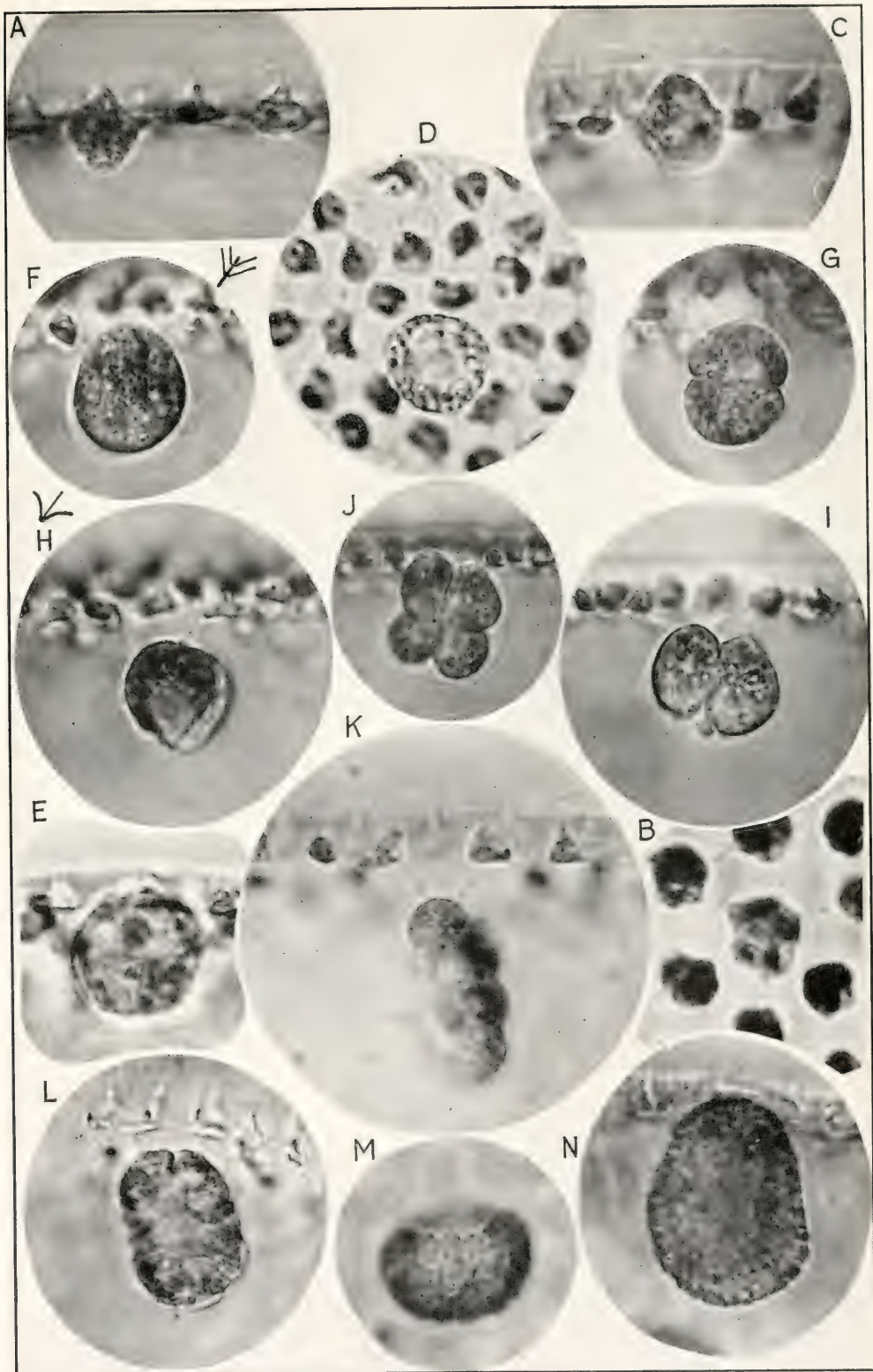




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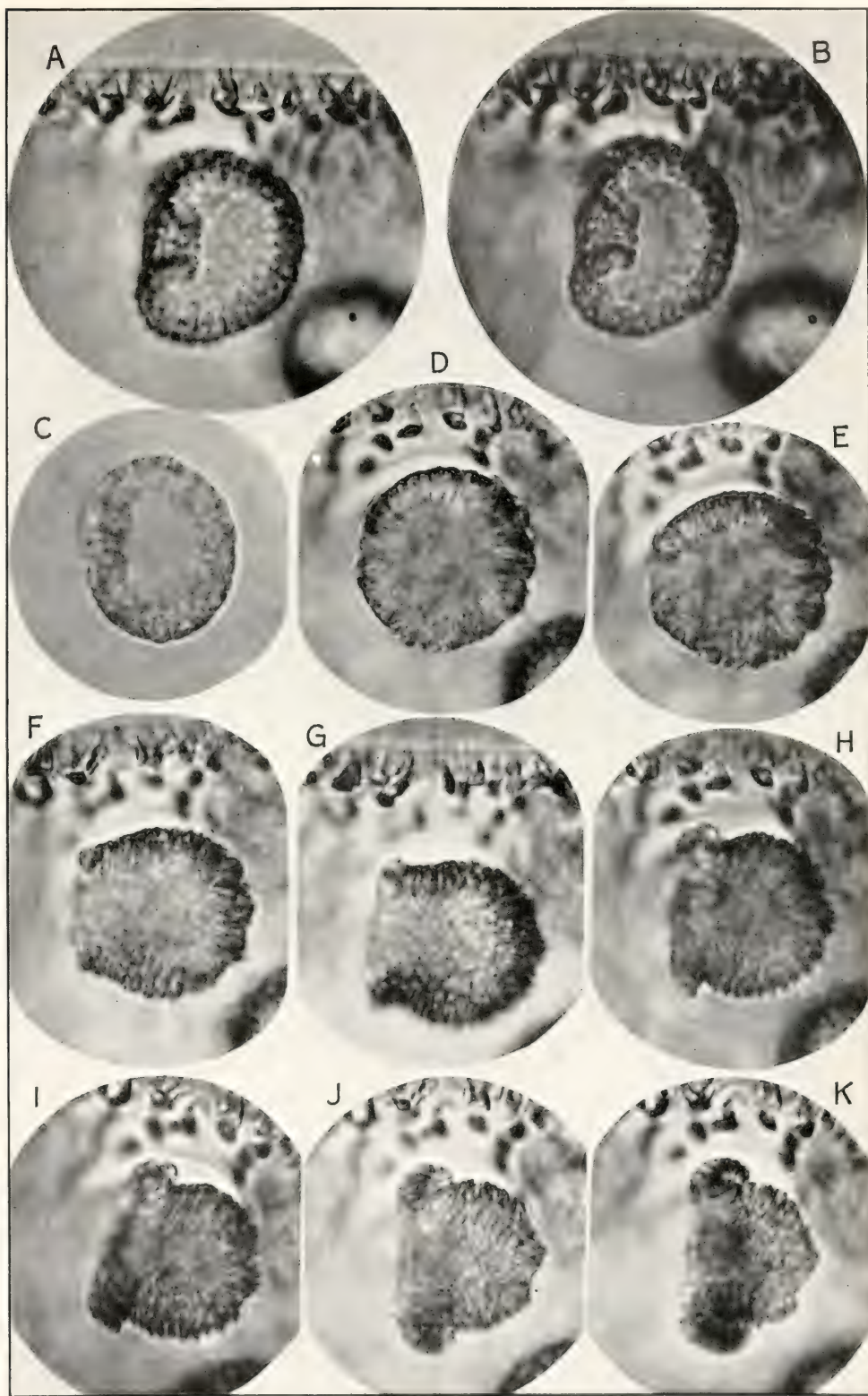






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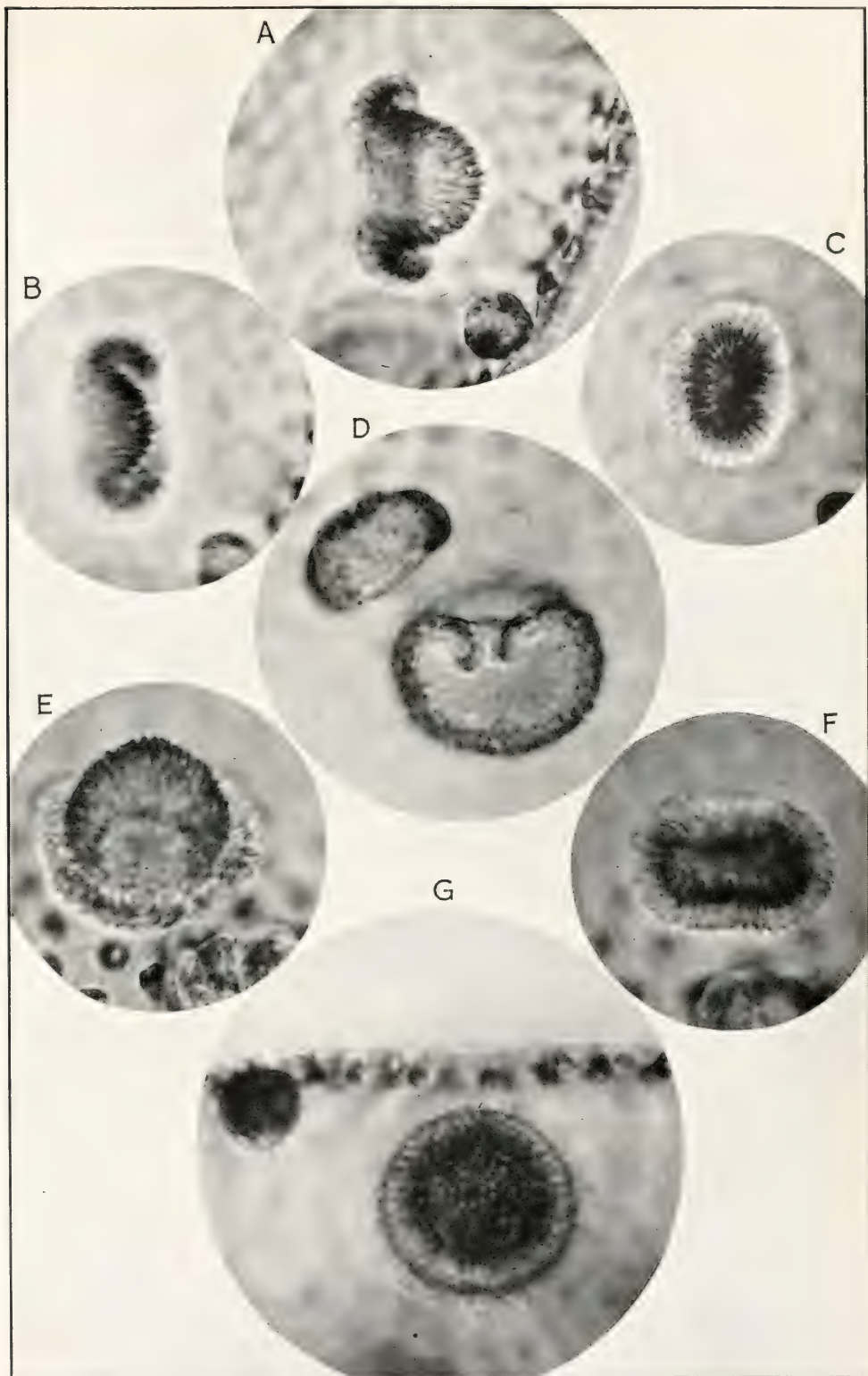




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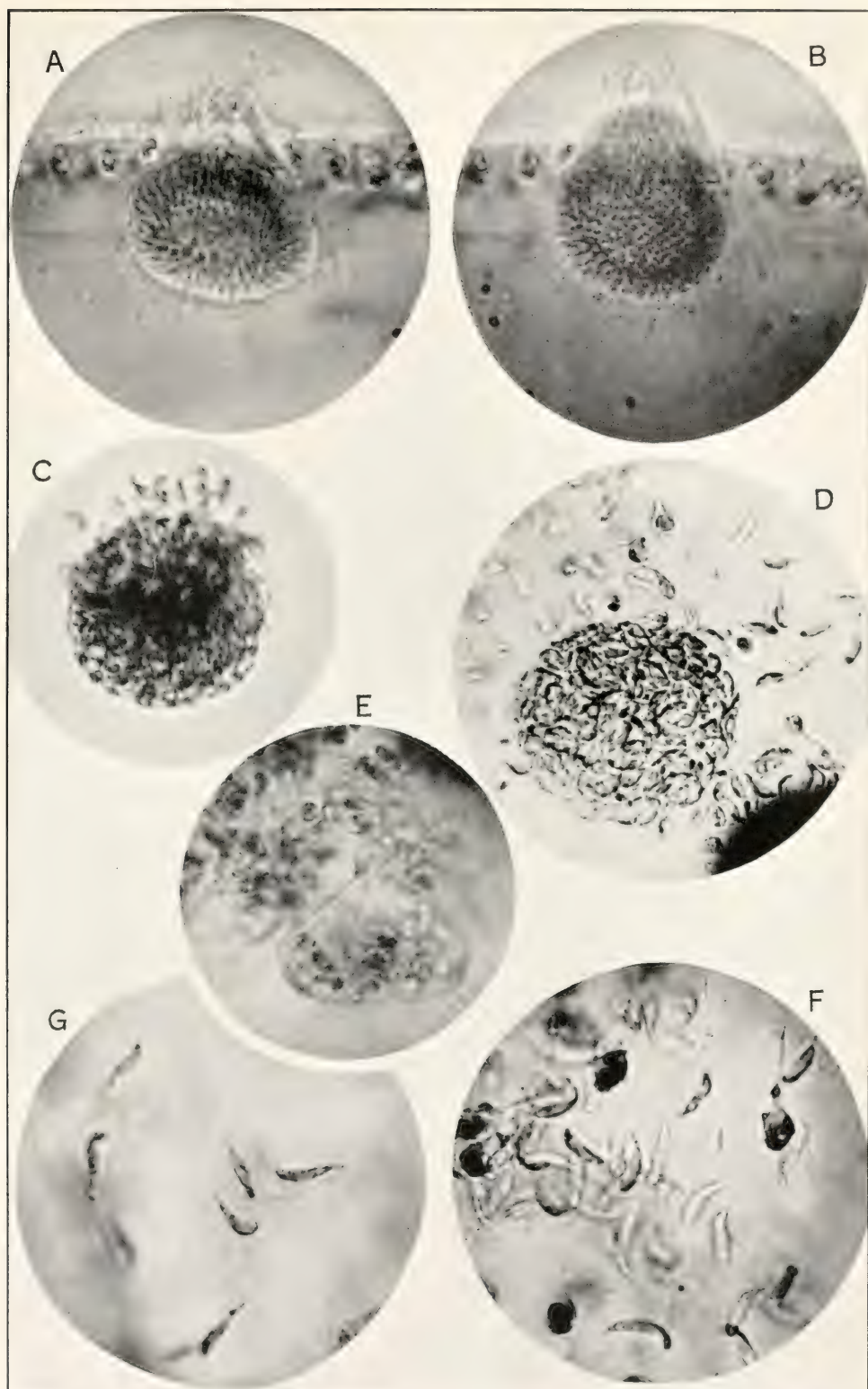




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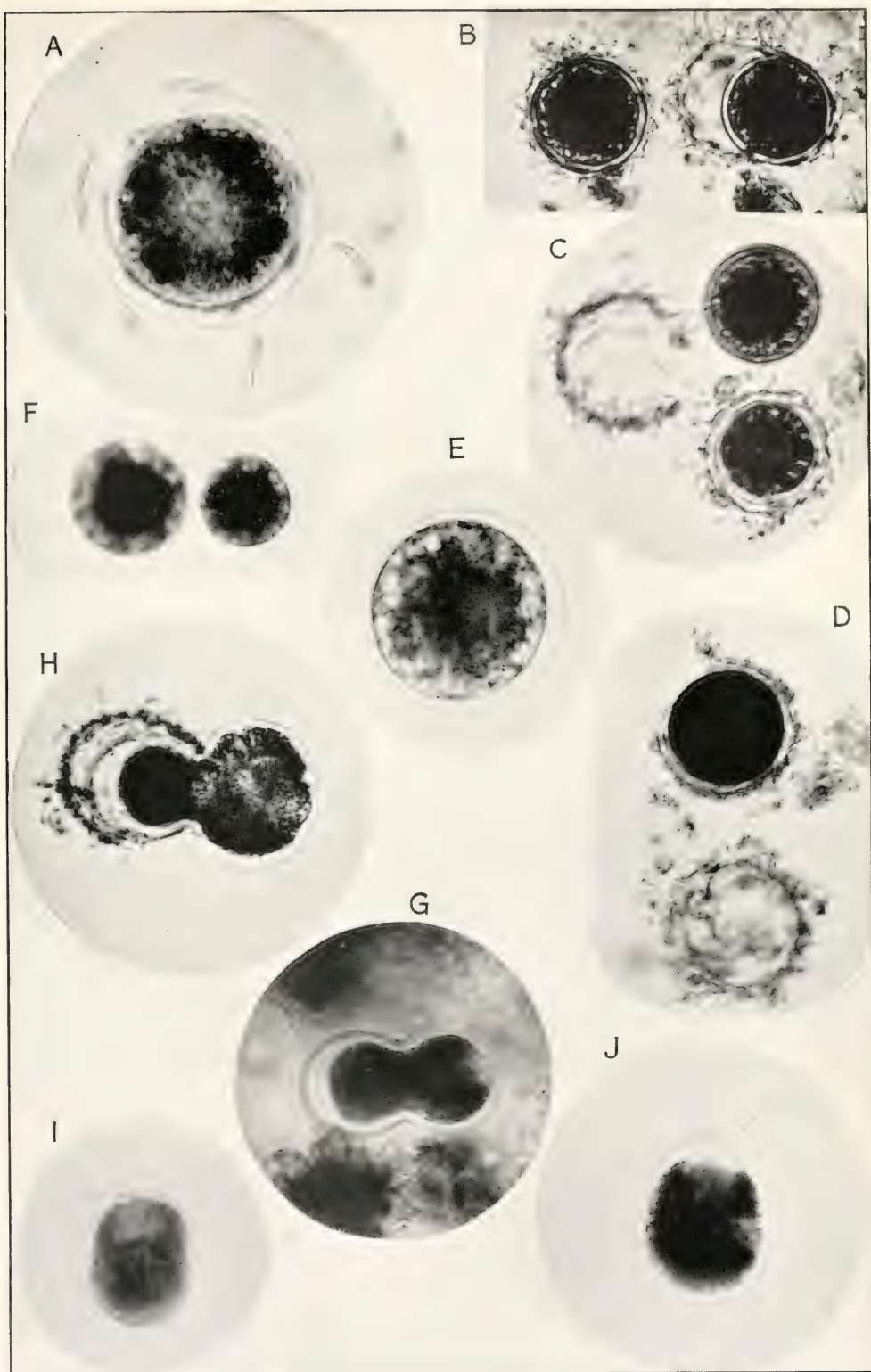






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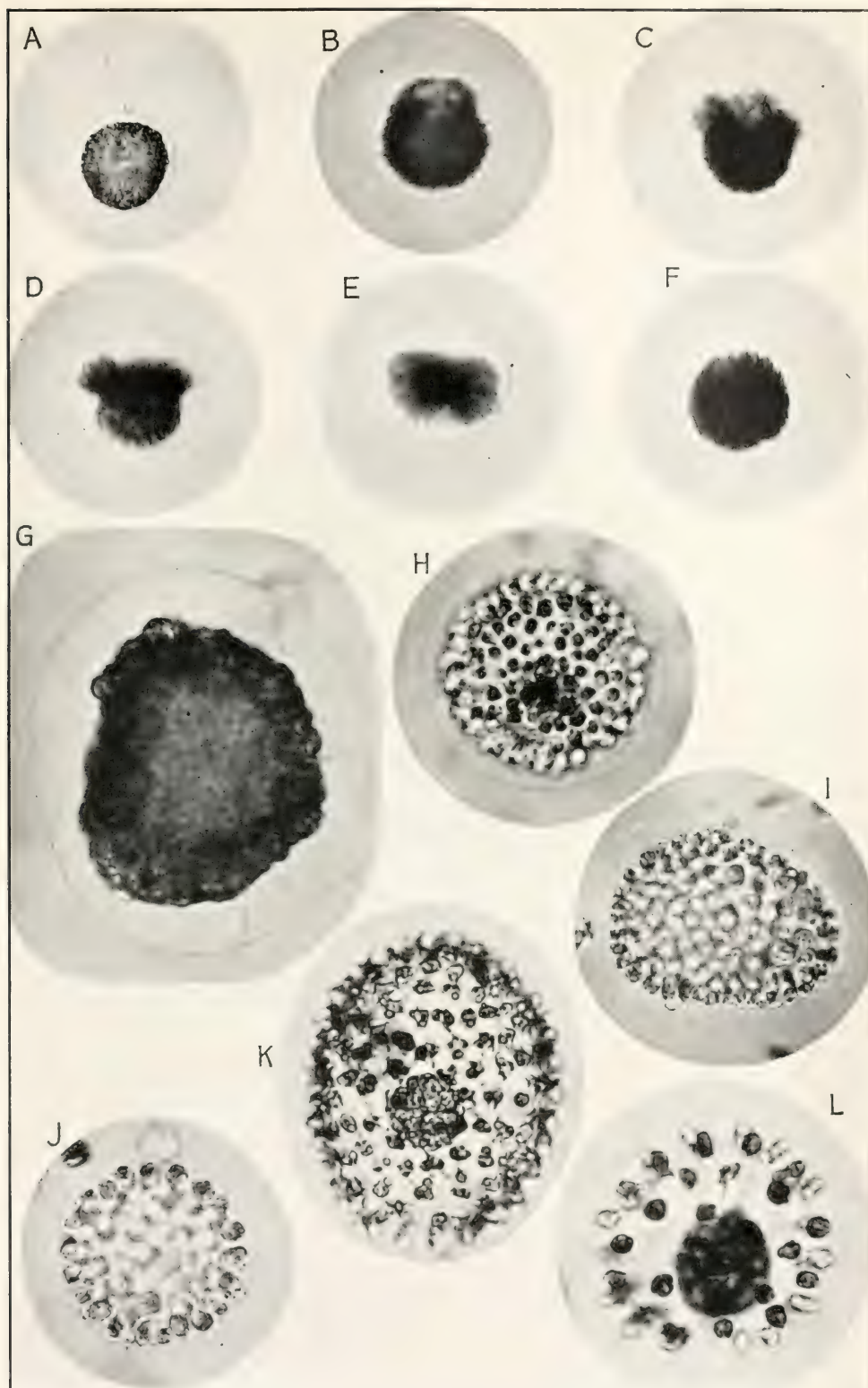




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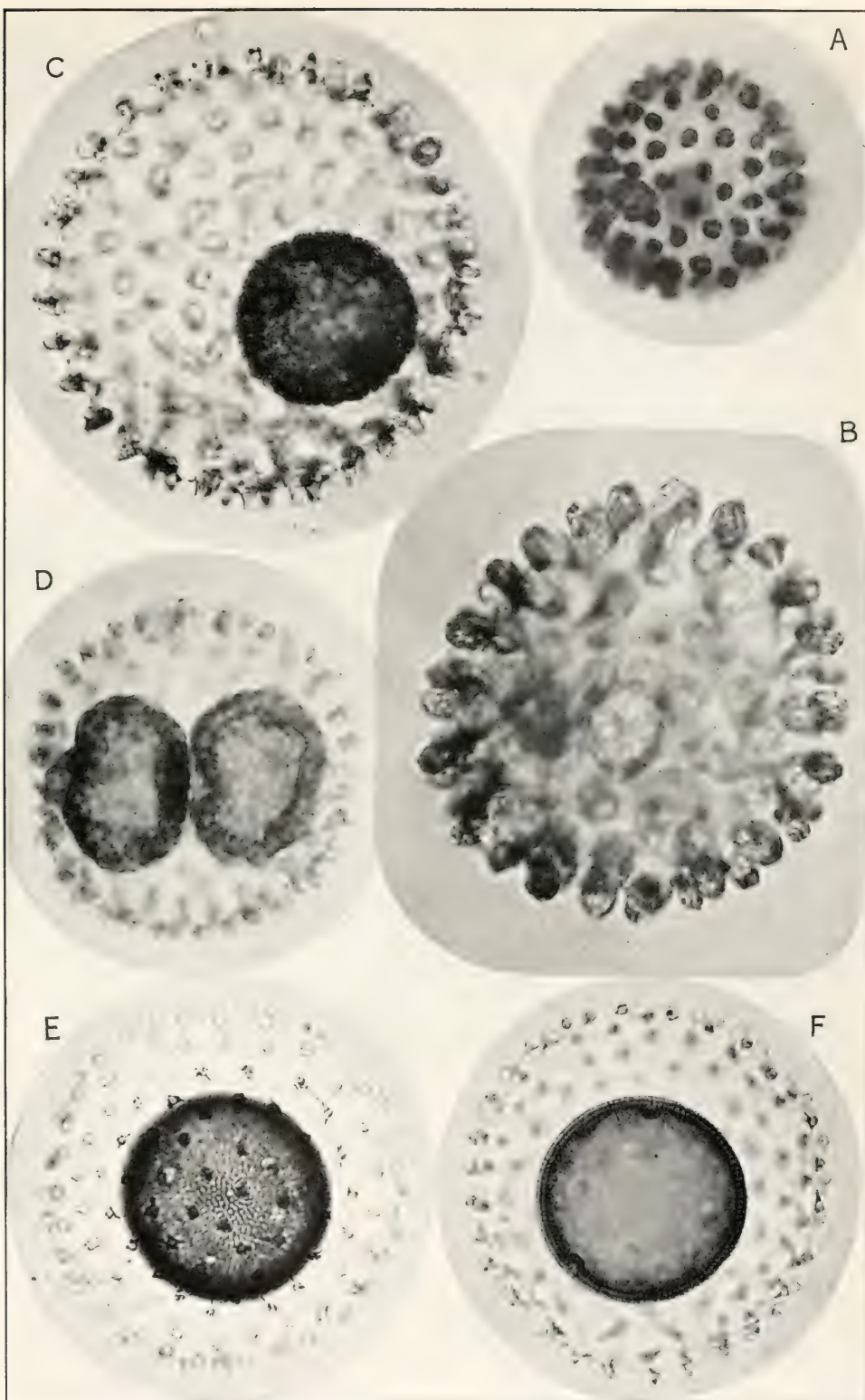






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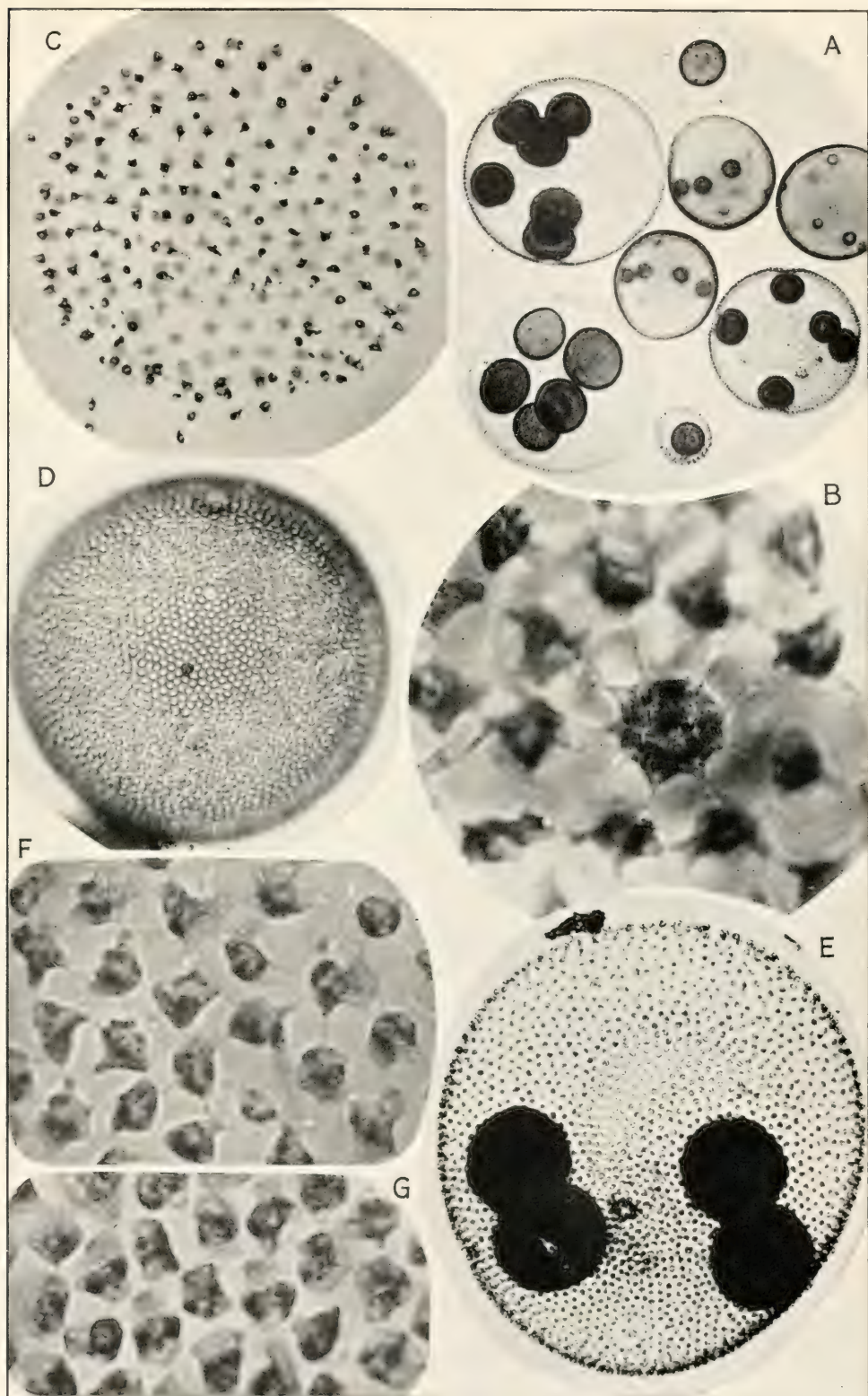




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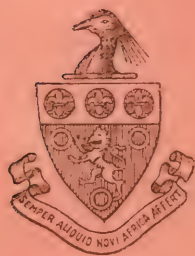
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